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ABSTRACT

This extensive report describes activities of the PEACESAT AUSTRALIA Project (the Kangaroo Network) which parallels, on the Australian continent, the endeavors of PEACESAT (Pacific Educational and Communication Experiment by SATellite), and other Pacific Basin ATS-1 networks. An executive summary reviews the development of the project and its philosophy and objectives, which include using a network of low-cost ground terminals to give small users an opportunity to discover effective satellite applications. Also described are the network and subnetworks, network coordination, access procedure, scheduling, access to other ATS-1 networks, application and technical experiments, the experimenters, technical matters, evaluation, and plans for 1984. Additional chapters provide details on sites, their institutions, and their status; geographical location; project membership, institutions, and personnel; and project subnetworks. Also included are a Kangaroo Network weekly schedule and priority times; ATS-1 weekly schedule; sample list of experiments and experimenters; list of ground station equipment; four institutional proposals for 1984; list of 31 publications; and miscellaneous items relating to current activities. An annex, "ATS-1 in Perspective," discusses the ATS-1 satellite, current usage of ATS-1 in Australia, the advantages and disadvantages of ATS-1, prospects for use of two Australian domestic satellites scheduled for launch in 1985 (AUSSAT), and conclusions. A 10-item reference list is provided. (LMM)

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Kangaroo Network

Annual Report

1983

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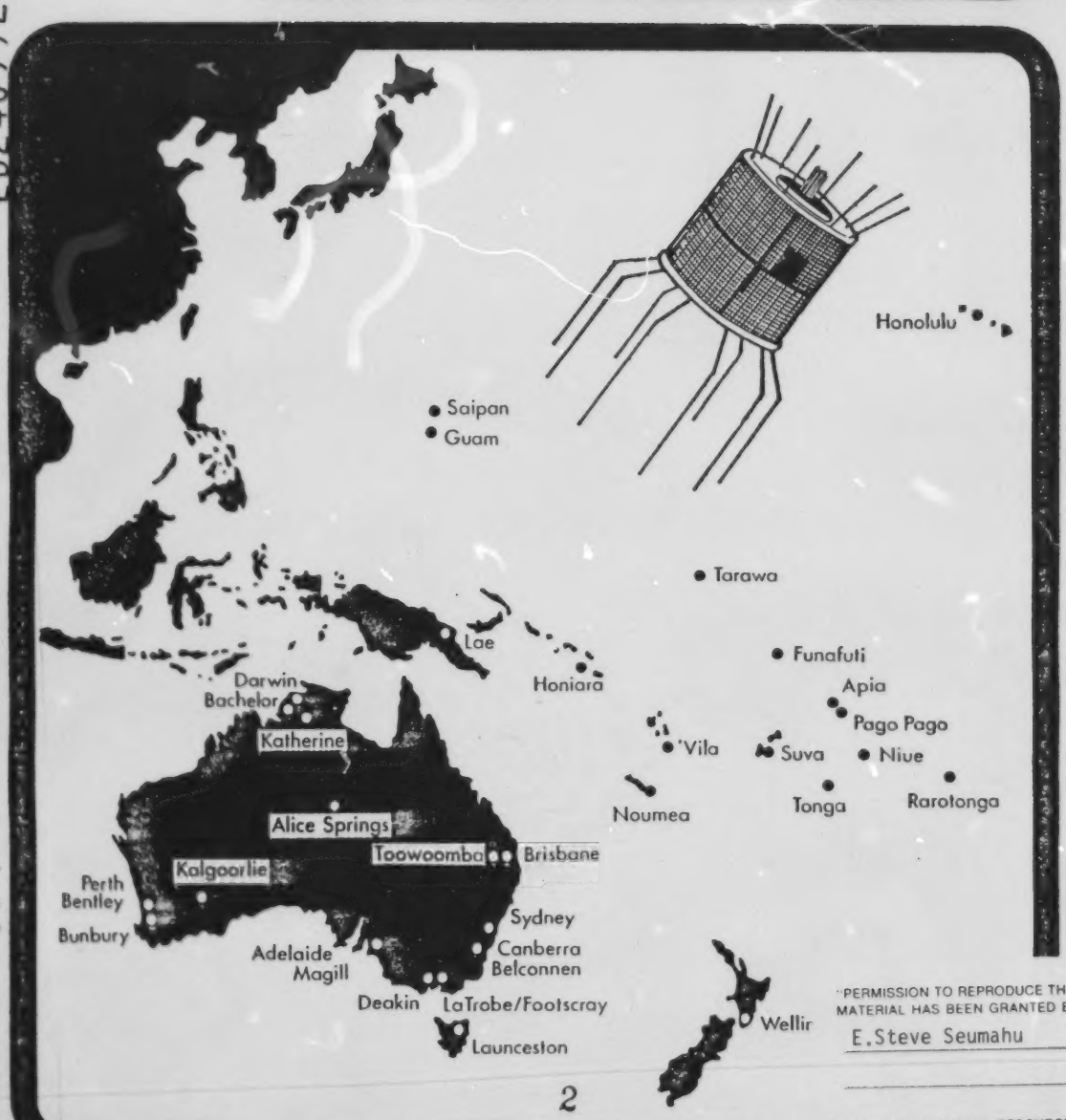

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Do you know, Mr. Hopper, dear Agatha and I are so much interested in Australia. It must be so pretty with all the dear little kangaroos flying about.

WILDE (Duchess of Berwick, Act II)

Many may consider the solution proposed in this discussion too far-fetched to be taken very seriously.

ARTHUR C. CLARKE (Extra-Terrestrial Relays)

PEACESAT AUSTRALIA Project (Kangaroo Network),
Department of Electronic and Communication Science,
La Trobe University, Bundoora, Victoria 3083, AUSTRALIA

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1. EXECUTIVE SUMMARY

Dr. E. Steve Seumahu, National Coordinator

PEACESAT AUSTRALIA Project (Kangaroo Network)

1.1 Introduction

PEACESAT AUSTRALIA is a project which parallels, on the Australian continent, the endeavours of PEACESAT (Pacific Educational And Communication Experiment by SATellite), USP (the University of South Pacific Satellite Project), DISP (Department of Interior Satellite Project) and other ATS-1 networks in the Pacific basin. The project was made possible by NASA's decision to move the ATS-1 satellite from 149° west longitude to 164° East longitude during 1982.

Prior to 1982 there were only two ATS-1 ground stations in this continent which are compatible with the Pacific-wide activities. One station was located at Canberra and was used briefly for communication with National Institute of Health near Washington DC. The other station was SYDNEY which was used mainly for packet-switching experiments among the University of Sydney, Tohoku University in Japan, and the University of Hawaii. The Sydney station was also used occasionally as a PEACESAT terminal. There were no domestic network in existence before 1982.

The westward move of ATS-1 came at the time when there was a growing interest in the possible non-commercial applications of satellite communication technology among educational, health, scientific, community development and other public-welfare institutions. This interest was caused by the expectation that an Australian domestic satellite system would be launched in 1985. Organizations such as the Satellite and Telecommunication Users Association (SAT users) were formed to look after the interest of the above group of potential users of satellite services. The group is often referred to as the "small users" group.

Before 1982 there was a lack of first hand experience by small users in Australia on the use of communication satellite technology. Thus the PEACESAT AUSTRALIA project was initiated by La Trobe University in cooperation with SAT users to give the small users a chance to experiment and gain the necessary experience in several aspects of satellite communication which would be of great use in public interest activities. These aspects include broadcasting, tele-conferencing, tele-classroom and tele-tutorial which can be done using voice, facsimile, teletype, computer communication, data transfer and slow-scan or freeze-frame television. Experiments in many of these areas have been conducted for more than 11 years by public-interest institutions around the Pacific under a different set of geographical conditions.

The utility of the ATS-1 channel, and the fact that the satellite can be accessed for two-way communication using very simple ground equipment, make it ideally suited for PEACESAT AUSTRALIA purposes. The project officially started on 31st May 1982 when LA TROBE ground station became operational and joined SYDNEY in the first domestic network for packet-switching experiments.

1.2 Philosophy and Objectives

The objectives of the PEACESAT AUSTRALIA project are

(i) To provide first hand experience in the use of communication satellites, in particular the use of voice-band channel for broadcasting, tele-conferencing, tele-classroom and tele-tutorial applications and the use of analog and digital technology with these applications.

(ii) To encourage experimentation to discover the areas of application which would be most appropriately served by satellites.

(iii) To assist small users to articulate and convey their needs for appropriate satellite facilities on board the national satellite system.

(iv) To discover and develop potential user groups who would be able to make use of the national satellite system.

(v) To participate in current international experiments within the existing Pacific-wide PEACESAT network.

The philosophy of the PEACESAT AUSTRALIA project is to give the opportunity to as many individuals and institutions as possible and to promote experimentations and demonstrations rather than commitment to satellite solution to the exclusion of established terrestrial systems.

1.3 The Kangaroo Network

A network of low-cost ground terminals, typically costing no more than $3,000 each, has been established around Australia to carry out the objectives of the PEACESAT AUSTRALIA project. This network is known as the "KANGAROO NETWORK" and consists of ground stations owned and managed independently by individual participating institutions.

At December 1983 there are a total of 57 sites registered with PEACESAT AUSTRALIA. Of these, 26 sites have fully operational ATS-1 ground stations, 15 sites are in the process of assembling the necessary equipment and going through the paper work to formalize their access, while 16 sites are still in the exploratory stage. A total of some 45 different institutions are involved in the project, with some institutions owning more than one site and some sites working for more than one institution.

A list of the sites, the institution and their status are given in Section 2 of this report. The geographical locations are indicated on the map in Section 3. Section 4 details the membership, institutions and personnel involved in the project.

Although the total number of sites is larger than for any other ATS-1 network , the average traffic from individual sites is relatively very low. The total traffic has been comfortably catered for so far within the time allocated to the Kangaroo network.

1.4 Sub-networks

As can be seen from Sections 2,3 and 4, there is a great diversity of interest and function within the Kangaroo network. To accommodate this diversity, several sub-networks have been formed or planned. The most active sub-nets have been given special priority times. Other subnets are convened on a

needs basis and utilize the rest of the allocated network times or any of the idle priority times. Eight sub-nets are active in 1983 whilst others are being planned for 1984 and beyond.

The details of the registered sub-nets at December 1983 are given in Section 5 of this report. Participation in the sub-nets are indicated in Section 2 and the priority times are shown in Section 6.

1.5 Network Coordination

Each site in the Kangaroo network is autonomous and independently financed and managed by its owner institution. National coordination covers the access and development aspects of ATS-1 usage and the time scheduling of various experiments. The initiation and conduct of experiments are left to the owner institutions and sub-net coordinators. Evaluation and progress reports are the onus of the institutions involved who would need to provide these to their sponsors. However, each institution undertakes to provide material for the overal PEACESAT AUSTRALIA annual report.

The history of the coordination of the PEACESAT AUSTRALIA project went back to January 1982 when representatives of the International PEACESAT Consortium and the existing ATS-1 network coordinators met with NASA representatives on 2 days during the PTC'82 (Pacific Telecommunication Council) conference in Honolulu. At these meetings NASA outlined its action in moving the ATS-1 satellite westward and invited new user groups to take advantage of the move.

Professor John Bennet and Dr. Ian Parkin of the University of Sydney attended these meetings together with Dr. Steve Seumahu from La Trobe University. The University of Sydney is a member of the Consortium and owns an operational ATS-1 ground station. La Trobe University was then providing honorary technical consultancy for the Consortium. Dr. Seumahu had represented the Consortium at International meetings of the ITU (International Telecommunications Union) and the historic WARC-79 (World Administrative Radio Conference) meeting in Geneva. Dr. Sumahu also had wide experience with ATS-1, being the initiator of the LAE ground station in 1971 and the manager of the station from 1972 to 1977.

It was agreed by the Australian representatives, the ATS-1 network coordinators and NASA that Dr. Seumahu should investigate the possible usage in Australia and coordinate any development from that continent. An article in SAT users newsletter of April 1982 was the follow up from these discussions and resulted in the establishment of the PEACESAT AUSTRALIA project.

Following the PTC-82 meetings, NASA delegated the overall coordination of ATS-1 usage to Dr. Donald M. Topping of the Social Science Research Institute at the University of Hawaii (NASA Telex dated 10/5/82). To facilitate the orderly development of the usage of ATS-1 by Australian institutions, Dr. Topping delegated the coordination of overall Australian activities to Dr. Steve Seumahu at La Trobe University (letters dated 23/7/82). This coordination consists of dissemination of information, technical and procedural consultations with interested institutions, liaison between potential Australian users and Dr. Topping, liaison between potential users and existing Pacific networks, licensing negotiations with Department of Communications, reporting to NASA and liaison with AUSSAT.

At a further meeting in January 1983 during PTC-83 a report was presented to the NASA representatives, the Consortium and other ATS-1 network coordinators on the progress in Australia. As a result of this meeting a substantial increase in time allocation was given to the Kangaroo network.

The coordination of Australian usage of ATS-1 in 1983 was agreed to in consultations with all the other ATS-1 networks. The details of inter-network coordination are spelled out in two articles entitled "ATS-1 Scheduling" and "ATS-1 Protocols" and were reproduced in the 1983 editions of the Kangaroo Network Bulletin.

1.6 Access Procedure

For any Australian ground station to access the ATS-1 satellite for two-way traffic requires the following:

(i) A suitable transmitting equipment licenceable by the Department of Communications.

(ii) An "Earth Station Class A" transmitting licence from the Department of Communications at an annual fee of $250. Application for this licence is lodged using standard forms obtainable from the State Regulatory and Licencing branch of that Department.

(iii) The written permission by Dr. Don Topping to access the ATS-1. Application for this must be addressed in writing to Dr. Topping. The application must clearly state the nature of the proposed application, including relevant details such as the frequency of usage, and the stations with which communications are to be established.

A recommendation by Dr. Seumahu, as the overall coordinator for Australia, will assist Dr. Topping with the evaluation of the application. It is therefore suggested that the application be forwarded to Dr. Seumahu in the first instance. He will pass on the application, together with his recommendation to Dr. Topping.

Where available, a photocopy of the licence should accompany the application. In any case, the permission by Dr. Topping will only be effective when either he or Dr. Seumahu have sighted a photocopy of the licence.

(iv) The permission of the network coordinator to enable an individual station to use the time-block allocated to the Kangaroo Network.

(v) An undertaking to supply information to the network coordinator for the compilation of annual reports to Dr. Topping and NASA.

1.7 Scheduling

The time allocated to the Kangaroo network as a whole is shown in Section 7. Australian stations share these times for domestic and sometimes international traffic. The sharing is coordinated by means of a weekly scheduling and message session on Tuesday 0500-0600 UTC. All Kangaroo network stations are encouraged to monitor this time slot every week.

Certain Kangaroo network times have been reserved on a priority basis for the most active sub-nets. These times are shown in Section 6. Such times may only be used for other purposes during idle periods and with the permission of the sub-net coordinator.

1.8 Access to Other ATS-1 Networks

Direct access to PEACESAT Network is available for the 8 Gateway stations mentioned in Section 5 by means of daily message sessions between 0300 and 0315 UTC. All other Kangaroo network stations may access PEACESAT by contacting one of the 8 gateway stations to alert the PEACESAT coordinator or by listening in for special invitation by the chairing stations of a particular PEACESAT session.

Access to other networks such as USP, OCEAN, COMPUTER, ASIAN and MICRONET is by special arrangement with their network coordinators.

Domestic traffic is normally conduc ted during the allocated Kangaroo network times only.

1.9 Application Experiments

Many application experiments were conduc ted in 1983 within the Kangaroo network. These are mainly in the areas of primary/secondary education, tertiary distance education and public-interest activities. Several of these experiments involve ATS-1 stations outside Australia. A sample list of these experiments are contained in Section 8.

Because of the involvement of a large number of ground stations, each with relatively low traffic, it is not enough to measure the volume of ATS-1 usage in terms of hours alone. A more meaningful measure is the product of the number of station actually taking part in an experimental session and the duration of that session. We shall call this measure "terminal-hours". The number of terminal hours generated by the Kangaroo network during 1983 is also shown in Section 8.

1.10 Technical Experiments

Several technical experiments were conducted in 1983. These include computer communication, packet-switching, police security communication etc. Sample experiments have been included in Section 8.

1.11 The Experimenters

As noted earlier, there is a great diversity of interest and function within the Kangaroo network. This is reflected in a sample list of experimenters given in Section 9.

1.12 Technical Matters

A wide variety of equipment is used by the Kangaroo network ground stations. A sample of this equipment under the headings of transmitters, power amplifiers, transmitting antennas, receiving antennas, pre-amplifiers and receivers are listed in Section 10.

1.13 Evaluation

The evaluation of individual experiments are left to the institutions and their sponsors. Because most stations have only been operational for less than one year, no such evaluation would be complete at this stage.

It is also far too early to evaluate the PEACESAT AUSTRALIA project as a whole. However, early observation is that the project has created a great deal of interest and has managed so far to coordinate the diversity of interest successfully. Despite inconsistent technical quality of reception, much has been achieved and most experimenters often request one or more follow-up sessions.

The PEACESAT AUSTRALIA project differs from PEACESAT, USP, DISP and other existing ATS-1 project in that it involves many more ground terminals, it covers a much different geographical areas and it was conceived with a definite satellite for its long-term view, viz the Australian domestic system (AUSSAT).

In terms of its stated objectives, the PEACESAT AUSTRALIA project has already achieved several of these, at least as far as the existing operational stations are concerned. Section 11 of this report contains a few short reports and impressions by a sample of participating institutions. The ANNEX attached to the present report is the result of what PEACESAT AUSTRALIA has learned so far and how this is related to its long term options.

1.14 Plans for 1984

As far as 1984 is concerned, the biggest coordination effort will be directed toward consolidating the Kangaroo network and assisting in the development of proposed new stations. The technical and application experiments started in 1984 will continue with new experiments being added. Several institutional proposals for 1984 are given in Section 12 to indicate the direction the PEACESAT AUSTRALIA project is taking.

One member of the network, viz the University of Western Australia, has already engaged the services of Dr. James Lange to conduct a study on the application of satellite technology in education based on the experience of the PEACESAT AUSTRALIA project and the expected transition to AUSSAT. A lot of effort in 1984 will be directed by the Kangaroo network toward this study.

E. H. Semmler

Dec. 31, 1983

2. KANGAROO NETWORK - DECEMBER 1983

MAP REFERENCE NUMBER	STATION NAME	CALL SIGN	INSTITUTION	STATE	STATUS			SUB-NET PARTICIPATION													
					EXPLORATORY	ASSEMBLY/PAPER WORK	OPERATIONAL	PEACESAT GATEWAYS	OCCASSIONAL USE	PACKET SWITCHING/COMPUTERS	PRIMARY/SECONDARY	POLICE EMERGENCY	TERTIARY DISTANCE EDUCATION	W.A.I.T. DISTANCE EDUCATION	N.T.EDUCATION/S.O.A.	BATCHELOR COLLEGE	PUBLIC BROADCASTING	QUEENSLAND STATE	U.W.A./MURDOCH/W.A.I.T.	MISC.INSTITUTIONAL e.g. Magill Darling Down Capricornia Aboriginal Education etc.
1	SYDNEY	AX 31	University of Sydney	NSW			Jan.1,77	✓		✓											
2	LA TROBE	AX 38	La Trobe University	Vic.			May 31,82	✓		✓			✓				✓				
3	ADELAIDE	AX 33	Educational Technology Centre	S.A.			June 17,82	✓		✓	✓										
4	LA TROBE - PORTABLE	AX 39	La Trobe University	Vic.			July15,82		✓												
5	PERTH	AX 32	University of Western Australia	W.A.			Aug.16,82	✓					✓				✓		✓		
6	ADELAIDE-PORTABLE	AX 78	Educational Technology Centre	S.A.			Sept.21,82		✓		✓										
7	TOOWOOMBA	AX 77	Darling Downs Institute of Advanced Education	Qld.			Sept.22,82	✓		✓			✓	✓				✓		17	
12 8	COLLINGWOOD	AX 44	Victoria Police	Vic.			Oct.4,82		✓			✓								2	

MAP REFERENCE NUMBER	STATION NAME	CALL SIGN	INSTITUTION	STATE	STATUS			SUB-NET PARTICIPATION													
					EXPLORATORY	ASSEMBLY/PAPER WORK	OPERATIONAL	PEACESAT GATEWAYS	OCCASSIONAL USE	PACKET SWITCHING/COMPUTERS	PRIMARY/SECONDARY	POLICE EMERGENCY	TERTIARY DISTANCE EDUCATION	W.A.I.T. DISTANCE EDUCATION	N.T.EDUCATION/S.O.A.	BATCHELOR COLLEGE	PUBLIC BROADCASTING	QUEENSLAND STATE	U.W.A./MURDOCH/W.A.I.T.	MISC.INSTITUTIONAL e.g. Magill Darling Down Capricornia Aboriginal Education etc.
9	MAYLANDS	AX 42	Western Australia Police	W.A.			Oct.6,82		✓			✓									
10	WARILLA	AX 43	New South Wales Police	NSW			Oct.21,82		✓			✓									
11	WINNELLIE	AX 35	Northern Territory Police	N.T.			Oct.29,82		✓			✓									
12	MAGILL	AX 82	South Australian College of Advanced Education	S.A.			Dec.8,82			✓			✓				✓				✓
13	FOOTSCRAY	AX 30	Footscray Institute of Technology	Vic.			Dec.16,82		✓				✓								
14	DARWIN	AX 34	Darwin Community College	N.T.			Dec.22,82	✓					✓				✓				
15	BENTLEY	AX 83	Western Australia Institute of Technology	W.A.			May 18,83						✓	✓			✓		✓		

MAP REFERENCE NUMBER	STATION NAME	CALL SIGN	INSTITUTION	STATE	STATUS			SUB-NET PARTICIPATION												
					EXPLORATORY	ASSEMBLY/PAPER WORK	OPERATIONAL	PEACESAT GATEWAYS	OCCASSIONAL USE	PACKET SWITCHING/COMPUTERS	PRIMARY/SECONDARY	POLICE EMERGENCY	TERTIARY DISTANCE EDUCATION	W.A.I.T. DISTANCE EDUCATION	N.T.EDUCATION/S.O.A.	BATCHELOR COLLEGE	PUBLIC BROADCASTING	QUEENSLAND STATE	U.W.A./MURDOCH/W.A.I.T.	MISC.INSTITUTIONAL e.g. Magill Darling Down Capricornia Aboriginal Education etc.
16	BRISBANE	AX 88	Queensland Police	Qld.			June 9,83		✓	✓		✓								
17	BELCONNEN	AX 91	Canberra College of Advanced Education	ACT			July 26,83		✓				✓							
18	KATHERINE	AX 94	Katherine School of the Air	N.T.			Aug.3, 83		✓						✓					
19	BUNBURY	AX 85	Bunbury Advanced Education Centre (W.A.I.T.)	W.A.			Aug.11,83						✓	✓						
20	WESTON	AX 90	Federal Police	ACT			Sept.14,83		✓			✓								
21	DEAKIN-GEELONG	AX200	Deakin University	Vic.			Sept.16,83			✓			✓							
22	HOBART	AX 92	Tasmania Police	Tas.			Oct.13,83		✓			✓								

MAP REFERENCE NUMBER	STATION NAME	CALL SIGN	INSTITUTION	STATE	STATUS			SUB-NET PARTICIPATION												
					EXPLORATORY	ASSEMBLY/PAPER WORK	OPERATIONAL	PEACESAT GATEWAYS	OCCASSIONAL USE	PACKET SWITCHING/COMPUTERS	PRIMARY/SECONDARY	POLICE EMERGENCY	TERTIARY DISTANCE EDUCATION	W.A.I.T. DISTANCE EDUCATION	N.T.EDUCATION/S.O.A.	BATCHELOR COLLEGE	PUBLIC BROADCASTING	QUEENSLAND STATE	U.W.A./MURDOCH/W.A.I.T.	MISC.INSTITUTIONAL e.g. Magill Darling Down Capricornia Aboriginal Education etc.
23	TAMAR HOUSE	AX 93	Northern Territory Education Department	N.T.			Oct.14,83		✓						✓					
24	CANBERRA	AX 98	Australian National University	ACT			Oct.19,83	✓					✓				✓			
25	EDUCATION - PORTABLE	AX 96	Northern Territory Education Department	N.T.			Nov.11,83		✓						✓					
26	ALBANY		Albany Technical College	W.A.			Dec.7, 83		✓					✓						
27	ALICE SPRINGS	AX 95	Alice Springs School of the Air	N.T.		✓			✓						✓					
23	LEEDERVILLE	AX 81	Western Australia Education Department	W.A.		✓			✓		✓									

MAP REFERENCE NUMBER	STATION NAME	CALL SIGN	INSTITUTION	STATE	STATUS			SUB-NET PARTICIPATION													
					EXPLORATORY	ASSEMBLY/PAPER WORK	OPERATIONAL	PEACESAT GATEWAYS	OCCASSIONAL USE	PACKET SWITCHING/COMPUTERS	PRIMARY/SECONDARY	POLICE EMERGENCY	TERTIARY DISTANCE EDUCATION	W.A.I.T. DISTANCE EDUCATION	N.T.EDUCATION/S.O.A.	BATCHELOR COLLEGE	PUBLIC BROADCASTING	QUEENSLAND STATE	U.W.A./MURDOCH/W.A.I.T.	MISC.INSTITUTIONAL e.g. Magill Darling Down Capricornia Aboriginal Education etc.
29	ROCKHAMPTON	AX 99	Capricornia Institute of Advanced Education	Qld.		✓			✓				✓					✓		✓
30	ST. LUCIA		University of Queensland	Qld.		✓			✓				✓					✓		
31	ADELAIDE POLICE	AX 37	South Australia Police	S.A.		✓			✓			✓								
32	TOORAK		State College of Victoria	Vic.		✓			✓											✓
33	LAUNCESTON		Australian Maritime College & Tasmania C.A.E.	Tas.		✓		✓					✓							
34	BRUCE		Bruce College of Technical & Further Education	ACT		✓			✓											
35	BATCHELOR		Batchelor College	N.T.		✓										✓				

MAP REFERENCE NUMBER	STATION NAME	CALL SIGN	INSTITUTION	STATE	STATUS			SUB-NET PARTICIPATION													
					EXPLORATORY	ASSEMBLY/PAPER WORK	OPERATIONAL	PEACESAT GATEWAYS	OCCASSIONAL USE	PACKET SWITCHING/COMPUTERS	PRIMARY/SECONDARY	POLICE EMERGENCY	TERTIARY DISTANCE EDUCATION	W.A.I.T. DISTANCE EDUCATION	N.T.EDUCATION/S.O.A.	BATCHELOR COLLEGE	PUBLIC BROADCASTING	QUEENSLAND STATE	U.W.A./MURDOCH/W.A.I.T.	MISC.INSTITUTIONAL e.g. Magill Darling Down Capricornia Aboriginal Education etc.
36	BAMYILI		Batchelor College RATE Program	N.T.	✓											✓				
37	YUENDUMU		Adult Education	N.T.	✓											✓				
38	MET.BUREAU		Bureau of Meteorology	Vic.	✓				✓											
39	MACQUARIE		Macquarie University	NSW	✓				✓				✓							
40	WARRNAMBOOL		Warrnambool Institute of Advanced Education	Vic.		✓			✓				✓							
41	KELVIN GROVE		Brisbane College of Advanced Education	Qld.		✓							✓					✓		
42	CHURCHILL		Gippsland College of Advanced Education	Vic.	✓				✓				✓							

MAP REFERENCE NUMBER	STATION NAME	CALL SIGN	INSTITUTION	STATE	STATUS			SUB-NET PARTICIPATION													
					EXPLORATORY	ASSEMBLY/PAPER WORK	OPERATIONAL	PEACESAT GATEWAYS	OCCASSIONAL USE	PACKET SWITCHING/COMPUTERS	PRIMARY/SECONDARY	POLICE EMERGENCY	TERTIARY DISTANCE EDUCATION	W.A.I.T. DISTANCE EDUCATION	N.T.EDUCATION/S.O.A.	BATCHELOR COLLEGE	PUBLIC BROADCASTING	QUEENSLAND STATE	U.W.A./MURDOCH/W.A.I.T.	MISC.INSTITUTIONAL e.g. Magill Darling Down Capricornia Aboriginal Education etc.
43	MOSMAN		International Training Institute	NSW		✓			✓											✓
44	ARMIDALE		University of New England	NSW	✓				✓				✓							
45	KALGOORLIE	AX 84	Western Australia Institute of Technology	W.A.		✓								✓						
46	CARNARVON		Carnarvon Senior High School	W.A.	✓				✓		✓									
47	GERALDTON		Geraldton Regional Education Centre	W.A.	✓				✓											
48	MARYBOROUGH		Darling Down Institute of Advanced Education	Qld.		✓			✓									✓		✓
	24																			

MAP REFERENCE NUMBER	STATION NAME	CALL SIGN	I N S T I T U T I O N	STATE	STATUS			SUB-NET PARTICIPATION													
					EXPLORATORY	ASSEMBLY/PAPER WORK	OPERATIONAL	PEACESAT GATEWAYS	OCCASSIONAL USE	PACKET SWITCHING/COMPUTERS	PRIMARY/SECONDARY	POLICE EMERGENCY	TERTIARY DISTANCE EDUCATION	W.A.I.T. DISTANCE EDUCATION	N.T.EDUCATION/S.O.A.	BATCHELOR COLLEGE	PUBLIC BROADCASTING	QUEENSLAND STATE	U.W.A./MURDOCH/W.A.I.T.	MISC.INSTITUTIONAL e.g. Magill Darling Down Capricornia Aboriginal Education etc.
49	GLADSTONE		Capricornia Institute of Advanced Education	Qld.		✓			✓									✓		✓
50	TAMWORTH		University of New England	NSW	✓				✓				✓							✓
51	PORT ADELAIDE		Port Adelaide Community College	S.A.	✓				✓											✓
52	MOUNT ISA		Darling Downs Institute of Advanced Education	Qld.	✓				✓									✓		✓
53	COLLIE		Bunbury Advanced Education Centre	W.A.	✓				✓					✓						
54	BATHURST		Mitchell College of Advanced Education	NSW	✓				✓				✓							

MAP REFERENCE NUMBER	STATION NAME	CALL SIGN	INSTITUTION	STATE	STATUS			SUB-NET PARTICIPATION												
					EXPLORATORY	ASSEMBLY/PAPER WORK	OPERATIONAL	PEACESAT GATEWAYS	OCCASSIONAL USE	PACKET SWITCHING/COMPUTERS	PRIMARY/SECONDARY	POLICE EMERGENCY	TERTIARY DISTANCE EDUCATION	W.A.I.T. DISTANCE EDUCATION	N.T.EDUCATION/S.O.A.	BATCHELOR COLLEGE	PUBLIC BROADCASTING	QUEENSLAND STATE	U.W.A./MURDOCH/W.A.I.T.	MISC.INSTITUTIONAL e.g. Magill Darling Down Capricornia Aboriginal Education etc.
55	TOWNSVILLE		James Cook University	Qld.	✓				✓				✓					✓		
56	PORT HEDLAND		Western Australia Institute of Technology	W.A.	✓				✓					✓						
57	CAIRNS		Queensland Police	Qld.	✓				✓			✓						✓		

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TERRITORY
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WESTERN AUSTRALIA
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QUEENSLAND
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VICTORIA
A.C.T.
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TASMANIA
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4. MEMBER STATIONS AND ORGANIZATIONS

1. SYDNEY, NEW SOUTH WALES (AX 31)

Owner Institution:	University of Sydney New South Wales, 2006.
Coordinator:	Professor John Bennet, Head, Basser Department of Computer Science. (02)692-1120
Operator:	Doug Richardson (02)692-1120
Technical Personnel:	John Zig (02)692-1120

2. LA TROBE, VICTORIA (AX 38), VK3 APS

Owner Institution:	La Trobe University BUNDOORA, Victoria 3083.
Coordinator:	Dr. Steve Seumahu, Department of Electronic and Communication Science. (03)479-2036
Operators:	Graham Alston (03)479-2454 Steve Seumahu (03)479-2454
Technical Personnel:	Graham Alston (03)479-2454, VK3 KOA Graham Hedley (03)479-2178, VK3 YHG Steve Seumahu (03)479-2454, VK3 AQA Peter Stewart (03)479-2078, VK3 YET

3. ADELAIDE, SOUTH AUSTRALIA (AX 33)

Owner Institution:	Educational Technology Centre, 41 Flinders Street, ADELAIDE, South Australia 5000.
Coordinator:	Barry Germein (08)227-0863
Operators:	Barry Germein (08)227-0863 Colin Dunnet (08)227-0166 Raelene Aplin Sophia Sincock Beth Porter
Technical Personnel:	Brenton Brockhouse, VK5 ZKJ Derek Hockley

4. LA TROBE - PORTABLE, VICTORIA (AX 39)

Owner Institution:	La Trobe University BUNDOORA, Victoria 3083.
Coordinator:	Dr. Steve Seumahu, Department of Electronic and Communication Science (03)479-2036
Operators:	Graham Alston (03)479-2454 Steve Seumahu (03)479-2454
Technical Personnel:	Graham Alston (03)479-2454, VK3 KOA Graham Hedley (03)479-2178, VK3 YHG Steve Seumahu (03)479-2454, VK3 AQA Peter Stewart (03)479-2078, VK3 YET

5. PERTH, WESTERN AUSTRALIA (AX 32)

Owner Institution:	University of Western Australia NEDLANDS, Western Australia 6009.
Coordinator:	Neil Ingleton, Department of Extension Services (09)380-2631.
Operators:	Neil Ingleton (09)380-2631 James Lange (09)380-2631
Technical Personnel:	Fred Hayward (09)380-2558

6. ADELAIDE - PORTABLE, SOUTH AUSTRALIA (AX 78)

Owner Institution:	Educational Technology Centre, 41 Flinders Street, ADELAIDE, South Australia 5000.
Coordinator:	Barry Germein (08)227-0863
Operators:	Barry Germein (08)227-0863 Derek Hockley
Technical Personnel:	Brenton Brockhouse, VK5 ZKJ Derek Hockley

7. TOOWOOMBA, QUEENSLAND (AX 77)

Owner Institution:	Darling Downs Institute of Advanced Education, DARLING HEIGHTS, TOOWOOMBA, Queensland 4350.
Coordinator:	Vernon White Head, Department of External and Continuing Education (076)301-300
Operators:	Alistair Inglis (076)301-300 Ivy Youngberry (076)301-300 Carina Ferris (076)301-300
Technical Personnel:	Keith Hoffman (076)301-300, VK4 Vince Constable (076)301-300, VK4

8. COLLINGWOOD, VICTORIA (AX 44)

Owner Institution:	Victoria Police Department 380 William Street, MELBOURNE, Victoria 3000.
Coordinator:	Inspector Brian Poulter Officer in Chard, Radio Electronics Division (03)418-3215
Operators:	George Howard 418-3216 George Glover 418-3278 Brian Poulter 418-3215
Technical Personnel:	George Glover 418-3275, VK3 DIN Trevor Joppich 418-3275 Charles Weyne 418-3275 Brian Poulter 418-3275, VK3 RA George Howard 418-3275, VK3 ~~XD~~

9. MAYLANDS, WESTERN AUSTRALIA (AX 42)

Owner Institution:	Western Australia Police Headquarters 2 Adelaide Terrace, EAST PERTH, Western Australia 6000.
Coordinator:	Sergeant Tony Stanicic Workshop Supervisor, Police Communications Technical Section (09)272-5255
Operators:	Tony Stanicic (09)272-5255 Ron Fisher (09)272-5255 Kim Williams (09)272-5255
Technical Personnel:	Tony Stanicic (09)272-5255 Ron Fisher (09)272-5255 Kim Williams (09)272-5255

10. WARILLA, NEW SOUTH WALES (AX 43)

Owner Institution:	New South Wales Police P.O. Box 200, WARILLA, New South Wales 2528.
Coordinator:	Sergeant Ray O'Grady Officer in Charge, Police Communications Unit (042)964-444
Operator:	Ray O'Grady (042)964-444
Technical Personnel:	Ray O'Grady (042)964-444

11. WINNELLIE, NORTHERN TERRITORY (AX 35)

Owner Institution:	Northern Territory Police Force G.P.O. Box 63, DARWIN, Northern Territory 5794.
Coordinator:	Norbert Husmer Technical Workshop (089)844-222
Operators:	Alan Dixon (089)844-222 Norbert Husmer (089)844-222
Technical Personnel:	Alan Dixon (089)844-222 Norbert Husmer (089)844-222

12. MAGILL, SOUTH AUSTRALIA (AX 82)

Owner Institution:	South Australian College of Advanced Education, 15 Lorne Ave. MAGILL, South Australia 5072.
Coordinator:	Dr. Robert Goodwin Science Department (08)332-4711, ext. 254.
Operators:	Peter Spooner (08)332 ext. 377 Allan Moore (08)332 ext. 376
Technical Personnel:	Peter Spooner (08)332-4711 ext. 377 Allan Moore (08)332-4711 ext. 377

13. FOOTSCRAY, VICTORIA (AX 30)

Owner Institution:	Footscray Institute of Technology Ballarat Road, FOOTSCRAY, Victoria 3011.
Coordinator:	Dr. Oscar Gimesy Building Engineering Department (03)688-4236
Operator:	Neil Trainor (03)688-4450
Technical Personnel:	Neil Trainor (03)688-4349, VK3 IJ.

14. DARWIN, NORTHERN TERRITORY (AX 34)

Owner Institution:	Darwin Community College - Radio 8TOP-FM P.O. Box 40146 CASUARINA, Northern Territory 5792.
Coordinator:	John Abell Station Manager (089)204-266
Operators:	Dr. Kevin Livingston (089)204-483 Jillian Nicholls (089)204-234
Technical Personnel:	John Abell (089)204-266, VK8 ZET

15. BENTLEY, WESTERN AUSTRALIA (AX 83)

Owner Institution:	Western Australian Institute of Technology BENTLEY, Western Australia 6102.
Coordinator:	George Idle Head, Centre for External Studies and Continuing Education. (09)350-7253
Operators:	Alf Debnam (09)350-7710 George Idle (09)350-7253 Jenny Walsh (09)350-7496
Technical Personnel:	Paul Stephens (09)350-7361 Noel Gardiner (09)350-7955, VK6 NG

16. BRISBANE, QUEENSLAND (AX 88)

Owner Institution:	Queensland Police Department Commissioner's Office 30 Makerston Street, BRISBANE, Queensland 4000.
Coordinator:	Tom Noonan Officer in Charge, Radio and Electronics Section (07)226-6692
Operators:	Trevor Hart (07)226-6483 T.A.O'Brien (07)226-6716
Technical Personnel:	I.R. Horrocks (07)226-6374

17. BELCONNEN, AUSTRALIAN CAPITAL TERRITORY (AX 91)

Owner Institution:	Canberra College of Advanced Education P.O. Box 1, BELCONNEN, Australian Capital Territory 2616.	
Coordinator:	Dr. Paul Edwards School of Applied Science (062)522-515	
Operators:	Graeme Knight	(062)552-963
	Mark Blundell	(062)522-515
	Graeme Osborne	(062)522-111
Technical Personnel:	Dr. Paul Edwards	(062)522-515, VK1 ZPE

18. KATHERINE, NORTHERN TERRITORY (AX 94)

Owner Institution:	Katherine School of the Air (N.T. Education Department), Box 531, KATHERINE, Northern Territory 5780.
Coordinator:	Mike Forster Principal (089)721-833
Operator:	Mike Forster (089) 721-833

19. BUNBURY, WESTERN AUSTRALIA (AX 85)

Owner Institution:	W.A.I.T. - Bunbury Advanced Education Centre Box 578, BUNBURY, Western Australia 6230.
Coordinator:	Doug Parry Officer in Charge, External Studies (097)212-688
Operator:	Doug Parry (097)212-688

20. WESTON, AUSTRALIAN CAPITAL TERRITORY (AX 90)

Owner Institution:	Australian Federal Police P.O. Box 401, CANBERRA, Australian Capital Territory 2601.	
Coordinator:	Len Fahey Senior Technical Officer, Electronic Services (062)870-221	
Operators:	Len Fahey	(062)870-221
	R. Smith	(062)870-232
Technical Personnel:	Len Fahey	(062)870-221

21. DEAKIN - GEELONG, VICTORIA (AX 200)

Owner Institution:	Deakin University WAURN PONDS, Victoria 3217.	
Coordinator:	Dr. Nguyen Tran Electrical Engineering Department (052)471-231	
Operators:	Nguyen Tran	(052)471-231
	Paul Northcott	(052)471-415
	Eric Gough	(052)471-111
Technical Personnel:	Nguyen Tran	(052)471-231
	S. Hamilton	(052)471-231

22. HOBART, TASMANIA (AX 92)

Owner Institution:	Tasmania Police P.O. Box 308C, HOBART, Tasmania 7001.	
Coordinator:	Inspector Don Haas Officer in Charge, Communications Technical Division, (002)381-370	
Operators:	Don Haas	(002)381-370
	G. Harper	(002)381-310
Technical Personnel:	G. Harper	(002)381-310
	J. Wall	(002)381-291

23. TAMAR HOUSE, NORTHERN TERRITORY (AX 93)

Owner Institution:	Northern Territory Department of Education P.O. Box 4821, DARWIN, Northern Territory 5794.
Coordinator:	Dr. Norman Bowman Assistant Director, Research and Planning (089)804-274
Operator:	Norman Bowman (089)804-274

24. CANBERRA, AUSTRALIAN CAPITAL TERRITORY (AX 98)

Owner Institution:	Australian National University G.P.O. Box 5, CANBERRA, Australian Capital Territory 2601.	
Coordinator:	Yvonne Heslop Centre for Continuing Education (062)493-256, 492-892	
Operators:	Yvonne Heslop	(062)493-256
	Graeme Thomas	(062)494-754
Technical Personnel:	Chris Deacon	(062)644-646

25. EDUCATION - PORTABLE, NORTHERN TERRITORY (AX 96)

Owner Institutions:	Northern Territory Department of Education P.O. Box 4821, DARWIN, Northern Territory 5794.
Coordinator:	Dr. Norman Bowman Assistant Director, Research and Planning (089)804-274
Operator:	Norman Bowman (089)804-274

26. ALBANY, WESTERN AUSTRALIA

Owner Institution:	Albany Technical College, Anson Road, ALBANY, Western Australia 6330.
Coordinator:	John Thompson A/Head, Trades/Engineering Department (098)411-700
Technical Personnel:	John Thompson (098)411-700

27. ALICE SPRINGS, NORTHERN TERRITORY (AX 95)

Owner Institution:	Alice Springs School of the Air (N.T. Education Dept.) Box 1220 ALICE SPRINGS, Northern Territory 5750.
Coordinator:	Fred Hockley Principal (089)522-122
Operator:	Fred Hockley (089)522-122

28. LEEDERVILLE, WESTERN AUSTRALIA (AX 81)

Owner Institution:	Education Department of Western Australia P.O. Box 271 LEEDERVILLE, Western Australia 6007.
Coordinator:	Bob Rodgers Superintendent of Education, Audio-Visual Education Branch (09)321-2311
Operator:	Peter Hosie (09)321-2311
Technical Personnel:	Steve Pearce (09)321-2311

29. ROCKHAMPTON, QUEENSLAND (AX 99)

Owner Institution:	Capricornia Institute of Advanced Education ROCKHAMPTON, Queensland 4700
Coordinator:	Dr. John Dekkers (079)361-177
Operators:	Geoff Anger (079)361-177

30. ST. LUCIA, QUEENSLAND

Owner Institution:	University of Queensland ST. LUCIA, Queensland 4067.
Coordinator:	Professor John Chick Director, School of External Studies and Continuing Education (07)377-2323
Operator:	Peter Grayson (07)377-2288, (07)377-2207
Technical Personnel:	Prof. W. Gunn (07)377-2323

31. ADELAIDE POLICE, SOUTH AUSTRALIA (AX 37)

Owner Institution:	South Australian Police Department 1 Angas Street, ADELAIDE, South Australia 5000.
Coordinator:	Superintendent Bruce Gamble Officer in Charge, M.5 Division (08)218-1580
Operator:	Richard Thiel (08)218-1293
Technical Personnel:	David Banner (08)218-1293, VK5 NU Richard Thiel (08)218-1293, VK5 KRX

32. TOORAK, VICTORIA

Owner Institution:	Victoria College, Toorak Campus P.O. Box 224 MALVERN, Victoria 3144
Coordinator:	Alex Millar Head, Department of Educational Technology (03)202-501 ext. 311
Operator:	Jeff MacDonald (03)209-9011
Technical Personnel:	Jeff MacDonald (03)209-9011

33. LAUNCESTON, TASMANIA

Owner Institution:	Australian Maritime College P.O. Box 986 LAUNCESTON, TASMANIA 7250.
Coordinator:	Michael Collinson School of Engineering (003)260-751
Technical Personnel:	Geoffrey Wells (003)260-740, VK7 ZOO Michael Collinson (003)260-751, VK7 MA

34. BRUCE, AUSTRALIAN CAPITAL TERRITORY

Owner Institution:	Bruce College of Technical and Further Education Haydon Drive, BRUCE, Australian Capital Territory 2617
Coordinator:	Phillip Ibbotson Principal (062)520-511
Technical Personnel:	M. Priest (062)520-418 A. Knight (062)520-418

35. BATCHELOR, NORTHERN TERRITORY

Owner Institution:	Batchelor College BATCHELOR, Northern Territory 5791
Coordinator:	Kevin Kluken (089)760-002 Coordinator, Educational Media Unit (089)760-002

36. BAMYILI, NORTHERN TERRITORY

Owner Institution:	Batchelor College BATCHELOR, Northern Territory 5791
Coordinator:	Peter Plummer (089)760-002 Principal (089)760-002

37. YUENDUMU, NORTHERN TERRITORY

Owner Institution:	Adult Education YAENDUMU, Northern Territory.
Coordinator:	Peter Toyne

38. MET. BUREAU, VICTORIA

Owner Institution:	Bureau of Meterology P.O. Box 1289K MELBOURNE, Victoria 3001
Coordinator:	Lindsay Cole

39. MACQUARIE, NEW SOUTH WALES

Owner Institution:	Macquarie University NORTH RYDE, New South Wales 2113
Coordinator:	Malcolm Buck School of Earth Sciences (02)888-80000

40. WARRNAMBOOL, VICTORIA

Owner Institution:	Warrnambool Institute of Advanced Education P.O. Box 423 WARRNAMBOOL, 3280.
Coordinator:	F. Bosch Head, Education Unit and External Studies (055)640-218

41. KELVIN GROVE, QUEENSLAND

Owner Institution:	Brisbane College of Advanced Education 130 Victoria Park Road, KELVIN GROVE, Queensland 4059.
Coordinator:	Dr. Roy Lundin Head, Dept. of Librarianship and Teaching Studies and Coordinator of Continuing Education (07)356-7044

42. CHURCHILL, VICTORIA

Owner Institution:	Gippsland Institute of Advanced Education Switchback Road, CHURCHILL, Victoria 3842
Coordinator:	Michael Parer Head, Educational Development and Research (051)220-200

43. MOSMAN, NEW SOUTH WALES

Owner Institution:	International Training Institute Middle Head, MOSMAN, New South Wales 2091.
Coordinator:	Keith Jackson Mass Communication (02)969-1888
Operators:	Ken Terry (02)969-1888 Keith Jackson (02)969-1888
Technical Personnel:	Ken Terry (02)969-1888

44. ARMIDALE, NEW SOUTH WALES

Owner Institution:	University of New England ARMIDALE, New South Wales 2351
Coordinator:	Grant Noble Associate Professor, Psychology (067)732-545
Operator:	Grant Noble (067)732-545
Technical Personnel:	Gavin Mascord (067)732-587

45. KALGOORLIE, WESTERN AUSTRALIA (AX84)

Owner Institution:	Western Australia Institute of Technology BENTLEY, Western Australia 6102
Coordinator:	George Idle Head, Centre for External Studies and Continuing Education (09)350-7253

46. CARNARVON, WESTERN AUSTRALIA

Owner Institution:	Carnarvon Senior High School Cleaver Street, CARNARVON, Western Australia 6701
Coordinator:	Peter Scharf Science Master (099)411-334
Operator:	Peter Scharf (099)411-334
Technical Personnel:	Peter Scharf (099)411-334, VK6 APS

47. GERALDTON, WESTERN AUSTRALIA

Owner Institution:	Geraldton Regional Community Education Centre Association Forrest Lodge, Gregory Street, GERALDTON, Western Australia 6530.
Coordinator:	Paul Canet Director (099)214-477, (099)212-121
Technical Personnel:	Paul Canet (099)214-477, VK6 GK

48. MARYBOROUGH, QUEENSLAND

Owner Institution:	Darling Downs Institute of Advanced Education Darling Heights, TOOWOOMBA, Queensland 4350
Coordinator:	Alistair Inglis Dept. of External and Continuing Education (076)301-300

49. GLADSTONE, QUEENSLAND

Owner Institution:	Capricornia Institute of Advanced Education ROCKHAMPTON, Queensland 4700
Coordinators:	Dr. Rob Sunderland R. Young (079)361-177

50. TAMWORTH, NEW SOUTH WALES

Owner Institution:	University of New England Namoi Regional Office 81 Brisbane Street, TAMWORTH, New South Wales 2340
Coordinator:	Barrie Brennan Department of Continuing Education (067)663-860

51. PORT ADELAIDE, SOUTH AUSTRALIA

Owner Institution:	Port Adelaide Community College McLaren Parade, PORT ADELAIDE, South Australia 5015
Coordinator:	Kim Burger Historic Precinct (08)478-466

52. MOUNT ISA, QUEENSLAND

Owner Institution:	Darling Downs Institute of Advanced Education Darling Heights TOOWOOMBA, Queensland 4350
Coordinator:	Alistair Inglis Dept. of External and Continuing Education (076)301-300

53. COLLIE, WESTERN AUSTRALIA

Owner Institution: Western Australia Institute of Technology
BENTLEY, Western Australia 6102
Coordinator: George Idle
Head, Centre for External Studies and Continuing Education
(09)350-7253

54. BATHURST, NEW SOUTH WALES

Owner Institution: Mitchell College of Advanced Education
BATHURST, New South Wales 2795
Coordinator: David Russel
Geography Department
(063)311-022

55. TOWNSVILLE, QUEENSLAND

Owner Institution: James Cook University of Northern Queensland
TOWNSVILLE, Queensland 4811
Coordinator: Alan Cutting
Audio Visual Centre
(077)81-4111

56. PORT HEDLAND, WESTERN AUSTRALIA

Owner Institution: Western Australia Institute of Technology
BENTLEY, Western Australia 6102
Coordinator: George Idle
Head, Centre for External Studies and Continuing Education
(09)350-7253

57. CAIRNS, QUEENSLAND

Owner Institution: Queensland Police Department
c/- Box 1440, G.P.O.
BRISBANE, Queensland 4001
Coordinator: Tom Noonan
Officer in Charge, Radio and Electronics Section
(07)226-6692

5. SUB-NETWORKS

5.1 PEACESAT Gateways

A PEACESAT gateway station is a station which act as the main contact point between the Kangaroo network station in a particular State or Territory and the Pacific-wide PEACESAT network. The gateway station is usually active on a daily basis and takes part in all PEACESAT message and scheduling sessions.

It is not practicable for every single Kangaroo network station to be polled during a PEACESAT message or scheduling session. Hence only the gateway stations are called. Traffic from PEACESAT to other Kangaroo network stations is normally relayed through the appropriate gateway. In cases where the destination happens to be monitoring at that time, the message may be passed directly.

A non-gateway station with message to be passed to the PEACESAT network can do so by alerting its gateway station beforehand. The gateway station may pass the message verbatim, or by simply notifying the PEACESAT coordinator to refer to the originating station at the appropriate time. In case the gateway station is not operational at the required time, the originating station may contact the PEACESAT coordinator directly but must wait its turn as dictated by that coordinator.

Aside from the message and scheduling sessions, there are no restrictions on participation by any Kangaroo network station in the normal pre-arranged PEACESAT exchange. However, initiation or intention to participate in such exchanges are usually arranged during the message and scheduling sessions. Ad hoc participation may also be invited by the PEACESAT exchange coordinator.

During 1983 the gateway stations are SYDNEY (for New South Wales), LA TROBE (for Victoria), ADELAIDE (for South Australia), PERTH (for Western Australia), TOOWOOMBA (for Queensland), DARWIN (for Northern Territory), CANBERRA (for Austraian Capital Territory) and HOBART (for Tasmania). This situation may change in the future as other stations become operational in 1984. It is intended that gateway stations will be the ones with the most resources and participation for Pacific-wide activities.

5.2 Occasional Stations

Some Kangaroo network stations do not form regular part of a sub-net, i.e. they exist largely as a single unit. Most of these stations are built for institutional experimentation, as part of laboratory work or electronic projects or for portable applications at remote sites. These stations are activated only occasionally when required for a specific purpose. No set time schedule has been allocated for this type of application. Booking for time is arranged on ad hoc basis during Kangaroo network message and scheduling times.

5.3 Packet Switching/Computers

This is the first operational sub-net in Australia. It has its origin in a joint experiment conducted between the University of Sydney and Tohoku University in Japan prior to the westward move of ATS-1. The sub-net was used for packet switching experiments between SYDNEY and LA TROBE in 1982. During 1983 the membership is enlarged to include those stations which operate Apple II-compatible computers.

The original PACNET was coordinated by Dr. Ian Parkin of Basser Department of Computer Science at Sydney University. Because Sydney is inoperative for most of 1983 the PACNET scheduled times are often used for other purposes within the Kangaroo network. The Apple II activites form part of a Pacific-wide Computer network, lately coordinated by Peter Spooner of Magill with most of the work being done during MICRONET times.

5.4 Primary/Secondary Education

This sub-net was initiated by Colin Dunnet of the Educational Technology Centre in Adelaide at the time the Kangaroo network was being established. Its purpose is to experiment with satellite communication to aid the educational process in primary and secondary schools. Most of the work so far involves South Australia and Pacific-wide primary and secondary schools. The network will become more active on the domestic scene with the addition of several primary/secondary institutions in 1984. Coordination is in the hands of Barry Germein of ADELAIDE.

5.5 Police Emergency

The National Police Satellite Task Force has formed a sub-net for the purposes of experimentation, emergency communication and law enforcement. The sub-net consists of one station in each State or Territory viz. COLLINGWOOD (Victoria), MAYLANDS (Western Australia), WARRILLA (New South Wales), WINNELLIE (Northern Territory), BRISBANE (Queensland), WESTON (Australian Capital Territory), HOBART (Tasmania) and ADELAIDE POLICE (South Australia). A second station for Queensland is expected at CAIRNS during 1984. The sub-net is coordinated by Sergeant Ray O'Grady of the N.S.W. Police Communications Branch at Warilla. Sergeant O'Grady is the Chairman of the Task Force.

5.6 Tertiary Distance Education

This sub-net was initiated and coordinated by Dr. Kevin Livingston of Darwin Community College at DARWIN. Dr. Livingston has had wide experience with the USP project.

The Tertiary Distance Education sub-net conducts regular teleconferencing and seminars on topics of interest to distance educators in the tertiary sector. All tertiary institutions which conduct distance education in Australia are involved in some way in this sub-net, although not all of them have their own ground stations. The sub-net also includes institutions in the MICRONET, USP and New Zealand.

5.7 W.A.I.T. Distance Education

Because of its extensive distance education work which involves several remote centres, the Western Australian Institute of Technology has formed a sub-net to experiment with teletutoring and teleconferencing applications. Stations already operational are BENTLEY, BUNBURY and ALBANY with others anticipated in 1984. The sub-net is coordinated by George Idle of the Centre of External Studies and Continuing Education.

5.8 N.T. Education/School of the Air

Plans are well advanced for satellite experimentation in conjunction with existing HF networks of the Northern Territory Education Department, Katherine School of the Air and Alice Springs School of the Air. The sub-net will be coordinated by Dr. Norm Bowman of the N.T. Education Department. Four stations are already licensed, i.e. KATHERINE, TAMAR HOUSE, EDUCATION-PORTABLE and ALICE SPRINGS.

5.9 Batchelor College

Batchelor College is assembling the equipment for experiments on a sub-net to supplement its aboriginal teacher education work. Stations are planned for BATCHELOR, BAMYILI and YUENDUMU. The sub-net is being coordinated by Peter Plummer of Batchelor College.

5.10 Public Broadcasting

This sub-net uses existing ground stations. Many of these stations are connected with a community radio station, for example Radio 3RRR-FM (LA TROBE, R.M.I.T.), Radio 6 UVS-FM (PERTH), Radio 5 UV (MAGILL, University of Adelaide), Radio 8 TOP (DARWIN) etc. The sub-net has been used from time to time for consultations and experimentation in programming exchanges. Keith Jackson of Radio 2 SER-FM and Brian Walsh of the Public Broadcasting Association of Australia were the original coordinators of the sub-net. Since both men have left their former employment, the sub-net is now coordinated by others such as Dion Weston of Radio 3RRR-FM and John Abell of Radio 8 TOP.

5.11 Queensland State

A Queensland State sub-net has been proposed for intra-state activities involving institutions such as the police, universities and colleges of advanced education in the state. This sub-net will become active in 1984 when several new stations become operational in Queensland.

5.12 U.W.A./MURDOCH/W.A.I.T.

The University of Western Australia, Murdoch University and the W.A. Institute of Technology have many common interest in the field of distance education and satellite application. These three institutions have conducted joint investigations in the past and are proposing to use the sub-net for further collaboration in the future.

5.13 Miscellaneous Institutional

Several existing and expected stations have indicated their wish for small-scale institutionalised sub-nets for local activities. Examples are MAGILL, TOOWOOMBA, ROCKHAMPTON, TOORAK etc. It is likely that several of these sub-nets will become operational in 1984.

6. KANGAROO NETWORK WEEKLY SCHEDULE AND PRIORITY TIMES

G.M.T. (UTC)	SUN	MON	TUE	WED	THU	FRI	SAT	Eastern Standard Time
0000								10 AM
0100		PRI/SEC N.T. SOA	PRI/SEC BATCHELOR	PRI/SEC N.T. SOA	PRI/SEC BATCHELOR	PRI/SEC N.T. SOA		11 AM
0200								NOON
0300								1 PM
0400								2 PM
0500			MESSAGE & SCHEDULE	TERTIARY QUEENSLAND		TERTIARY		3 PM
0600								4 PM
0700								5 PM
0800								6 PM
0900								7 PM
1000		MAGILL	PACNET	W.A.I.T.	PACNET	PACNET		8 PM
1100		MAGILL		W.A.I.T.				9 PM
1200		PACNET	PACNET	PACNET	PACNET	PACNET		10 PM
1300								11 PM
1400								

7. ATS-1 WEEKLY SCHEDULE

G.M.T. (UTC)	SUN	MON	TUE	WED	THU	FRI	SAT	Eastern Standard Time
0000		MICRONET	MICRONET	MICRONET	MICRONET	MICRONET	MICRONET	10 AM
0100		KANGAROO	KANGAROO	KANGAROO	KANGAROO	KANGAROO		11 AM
0200	PEACESAT	ALL	USP	USP	USP	USP	USP	NOON
0300	PEACESAT	PEACESAT	PEACESAT	PEACESAT	PEACESAT	PEACESAT	PEACESAT	1 PM
0400	PEACESAT	PEACESAT	PEACESAT	PEACESAT	PEACESAT	PEACESAT	PEACESAT	2 PM
0500		PEACESAT	KANGAROO	KANGAROO	KANGAROO	KANGAROO		3 PM
0600		USP	USP	USP	USP	USP	USP	4 PM
0700		USP	USP	USP	USP	USP	USP	5 PM
0800		MICRONET	MICRONET	MICRONET	MICRONET	MICRONET		6 PM
0900		MICRONET	MICRONET	MICRONET	MICRONET	MICRONET		7 PM
1000		KANGAROO	KANGAROO	KANGAROO	KANGAROO	KANGAROO		8 PM
1100		KANGAROO	KANGAROO	KANGAROO	KANGAROO	KANGAROO		9 PM
1200		KANGAROO	KANGAROO	KANGAROO	KANGAROO	KANGAROO		10 PM
1300		ASIANET	ASIANET	ASIANET	ASIANET	ASIANET		11 PM
1400		ASIANET	ASIANET	ASIANET	ASIANET	ASIANET		
	E.S.T. MON	E.S.T. TUE	E.S.T. WED	E.S.T. THU	E.S.T. FRI	E.S.T. SAT	E.S.T. SUN	CHANGE OF DAY
1500	COMPUTER	COMPUTER	COMPUTER	COMPUTER	COMPUTER	COMPUTER	COMPUTER	1 AM
1600	COMPUTER	COMPUTER	COMPUTER	COMPUTER	COMPUTER	COMPUTER	COMPUTER	2 AM
1700	COMPUTER	COMPUTER	COMPUTER	COMPUTER	COMPUTER	COMPUTER	COMPUTER	3 AM
1800	COMPUTER	COMPUTER	COMPUTER	COMPUTER	COMPUTER	COMPUTER	COMPUTER	4 AM
1900	OCEAN	OCEAN	OCEAN	OCEAN	OCEAN	OCEAN	OCEAN	5 AM
2000	PEACESAT	PEACESAT	PEACESAT	PEACESAT	PEACESAT	PEACESAT	PEACESAT	6 AM
2100	PEACESAT	USP	PEACESAT	PEACESAT	PEACESAT	USP	PEACESAT	7 AM
2200	USP	USP	USP	USP	PEACESAT	USP	OCEAN	8 AM
2300	USP	OCEAN	OCEAN	OCEAN	OCEAN	OCEAN	OCEAN	9 AM
2400	MICRONET	MICRONET	MICRONET	MICRONET	MICRONET	MICRONET	OCEAN	10 AM

8. SAMPLE LIST OF EXPERIMENTS

NAME OF EXPERIMENT	TOTAL NUMBER OF TERMINAL-HOURS
Primary/Secondary Student Exchanges	21
Tertiary Distance Education (T.D.E.)	301
W.A.I.T. Student Tutorials/Seminars	41
Computers	196
National Conference, First Year of School (N.C.F.Y.S.)	1
Equipment for the Handicap	13
Nurses Education	3
Drama in Education	5
Education for Totally Dependent	7
New Technology for Teacher Librarians	2
Early Childhood Education	1
Media Education	1
Tertiary Education Tutorials	33
N.T. School Evaluation	1
Language Teachers Seminar	5
High School Exchange	1
Turf Culture	24
Boys Brigade	8
Women's International League for Peace and Freedom (W.I.L.P.F.)	10
Soroptimists International	12
Library Association	6
Pacific Youth Link	9
Agriculture Exchange	1
Girl Guide Leaders	9
Red Cross	14
Asia Pacific Regional Information Network (A.P.R.I.N.)	9
Pacific Islands News Association (P.I.N.A.)	3
Y.W.C.A.	20
Low-Level Radiation	1
Space Association	4
Jamboree on the Air (J.O.T.A.)	34
PEACESAT Consortium Council	4
Public Broadcasting Association of Aust. (P.B.A.A.)	5
PEACESAT Executive Board	9
PEACESAT Steering Committee	1
Reproductive Health	13
Vulcanology	4
Renewable Energy	5
Home Economists	2
Sea Scouts	1
ICDE/ASPESA Conference	10
National Police	20
Building Engineering	15
Pacific Archieves	2
Natural Family Planning	9
Open Day Activities	10
Rotary International	4
Astronomical Exchange	1
Breast Feeding	8
Wine Research	1
Slow-Scan TV	5
SPC News	3

Ocean Politics and Law	6
Demonstrations	8
Copyright Seminar	5
Experimant Art Foundation	1
TOP Project	4
Pacific Health	1
Interactive Video	4
PTC '84 Discussions	6
Various point-to-point Consultations	40
Ad Hoc Seminars	6

9. SAMPLE LIST OF EXPERIMENTERS

NAME OF EXPERIMENTER	INSTITUTION	NAME OF EXPERIMENT
Graham Alston	La Trobe University	J.O.T.A.
Prof.Francis Auburn	University of W.A.	T.D.E.
John Abell	Radio 8 TOP-FM	P.B.A.A.
Richard Aldous	Turf Association	Turf Culture
Neil Adams	Lake Karrinyap Country Club	Turf Culture
Elsie Ahrens	S.A.College of Adv.Ed.	Library Association
John Bayliss	Victorian Golf Course Superintendent Association	Turf Culture
Francis Boyd	Women's International League for Peace and Freedom	W.I.L.P.F.
Lee Birch	Soroptimist International of the South West Pacific	Soroptimist International
Tom Buchan	Australian Red Cross	Red Cross
Samantha Banfield	Girl Guides	Girl Guide Leaders
Catherine Balshaw	Girl Guides	Girl Guide Leaders
Jodie Banfield	Girl Guides	Girl Guide Leaders
Kay Bridgeman	Curriculum Programs	N.C.F.Y.S.
Heather Barton	Girl Guides	Girl Guide Leaders
Robert Broadbent	Aust.College of Education	PEACESAT Consortium
B. Brown	W.A.Inst. of Technology	W.A.I.T. Tutorial
Dr. John Barker	University of W.A.	T.D.E.
M. Brown	Y.W.C.A.	Y.W.C.A.
D. Barret	Y.W.C.A.	Y.W.C.A.
C. Boothby	N.T.Nursing Mothers Assoc.	Nurses Education
Fr. A. Braithwaitee	St.John's College Darwin	Media Education
Alan Bundy	Footscray Inst. of Tech.	Library Association
Bruce Burne	Victorian Archieves	Pacific Archieves
Nick Bell	Turf Association	Turf Culture
Terry Bell	" "	" "
John Barker	Rotary Governor	Rotary International
Garry Bromson	S.A.College of Adv.Ed.	T.D.E.
Tim Batersby	Norwood High School	High School
Mark Burr	Norwood High School	High School
Robert Cornell	Victorian Golf Course Superintendent Association	Turf Culture
J. Clough	Girl Guides	Girl Guide Leaders
Joan Crozier	Australian Red Cross	Red Cross
John Coleman	Space Association of Aust.	Space Association
Tracy Clayton	Girl Guides	Girl Guide Leaders
Jacinta Chenoweth	Girl Guides	Girl Guide Leaders
Lauren Carew	Girl Guides	Girl Guide Leaders
Andrew Carter	C.R.R.E.R.I.S.	A.P.R.I.N.
J. Campbell	W.A. Inst. of Technology	Computers
Dr. M. Campion	Murdoch University	T.D.E.
H. Court	W.A. College of Adv. Ed.	T.D.E.
B. Clinton	Aust. Red Cross	Red Cross
M. Cameron	Deakin University Library	ASPESA
M. Carnegie	N.T. Peace Council	W.I.L.P.F.
G. Cheater	Darwin Comm. College	ASPESA
D. Colgrove	Darwin Comm. College	Drama in Education

Prof. Cooley	N.T. Education Department	School Evaluation
Margaret Callister	Girl Guides	Girl Guide Leaders
Terry Cavanagh	Darling Downs I.A.E.	T.D.E.
Dr. Peter Cole	University of W.A.	Ed. Totally Dependent
Dr. David Carmichael	University of W.A.	Building Engineering
Barry Crocker	Deakin University	T.D.E.
Michael Collinson	Aust.Maritime College	T.D.E.
Giancarlo Chiro	S.A.College of Adv.Ed.	Computers
Sue Dyson	Y.W.C.A.	Y.W.C.A.
Alf Debnam	W.A.Inst. of Technology	T.D.E.
B. Durston	" " " "	T.D.E.
Dr. J. Dekkers	" " " "	W.A.I.T. Tutorial
M. Donovan	W.A. Education Dept.	Ed. Totally Dependent
Maureen Delaney	Nursing Mothers Assoc.	Breast Feeding
Joan Munskton	" " "	" "
Gun Dolva	W.A.Nuclear Disarmament	Women for Peace
Guglielono de Masi	S.A.College of Adv.Ed.	Language Teachers
Ann Forbes	Aeronautical Research Laboratories	Library Association
K. Fletcher	Girl Guides	Girl Guide Leaders
Helen Ferguson	Soroptimist International	Soroptimist International
Max Fielder	Turf Research Institute	Turf Culture
Jean Fowler	Girl Guides	Girl Guide Leaders
D. Fox	W.A.Inst. of Technology	Computers
Len Fahey	Federal Police	National Police
Lavina Ferris	Darling Downs I.A.E.	T.D.E.
Marilyn Freitag	Girl Guides	J.O.T.A.
Ron Fisher	W.A. Police	National Police
Richard Fuller	Norwood High School	High School
M.E.Hamel-Green	Nuclear Disarmament	Low-Level Radiation
Elaine Grose	Vic.Education Department	N.C.F.Y.S.
M. Green	W.A.Inst. of Technology	T.D.E.
P. Guiton	Murdoch University	T.D.E.
C. Griffiths	W.A.Education Dept.	Computer
Dr. Oscar Gimesy	Footscray Inst. of Tech.	Building Engineering
Dr. Oscar Gimesy	" " " "	PEACESAT Executive
George Glover	Vic. Police	National Police
Eric Gough	Deakin University	T.D.E.
Dr. Peter Greenwood	Tasmania Electricity Comm.	PEACESAT Consortium
Dr. Peter Greenwood	" " "	PEACESAT Executive
Sergio Galessi	S.A.College of Adv.Ed.	Computers
Dr.Robert Goodwin	S.A.College of Adv.Ed.	T.D.E.
Gordon Goulding	S.A.College of Adv.Ed.	Drama in Education
Ian Hamer	Dept. of Agriculture	A.P.R.I.N.
Sue Harvey	C.R.R.E.R.I.S.	A.P.R.I.N.
Geoffrey Hammond	Space Assoc. of Aust.	Space Association
Mark Hillier	Space Assoc. of Aust.	Space Association
Stuart Hosking	Warrnambool Institute of Advanced Education	T.D.E.
Graham Hedley	La Trobe University	J.O.T.A.
Dr. R. Hartley	W.A.Inst. of Technology	Computers
Dr. W. Honig	" " " "	Equipment Handicap
J. Hardy	W.A. Education Dept.	Early Childhood
R. Hunt	Y.W.C.A.	Y.W.C.A.
Warren Harding	Turf Association	Turf Culture
Dr.Peter Hartman	University of W.A.	Breast Feeding
Mike Hawson	Dept. of Agriculture	A.P.R.I.N.
Norbert Husmer	N.T. Police	National Police
George Howard	Vic. Police	National Police
Don Haas	Tas. Police	National Police
G. Harper	Tas. Police	National Police
Tonna Happe	Norwood High School	High School
Ian Hansen	Regency Park T.A.F.E.	T.D.E.

Margaret Irvine	Dept. of Agriculture	Agriculture Exchange
Margaret Insley	Girl Guides	Girl Guide Leaders
George Idle	W.A.Inst. of Tech.	T.D.E.
Alistair Inglis	Darling Downs Inst. of Advanced Education	T.D.E.
Neil Ingleton	University of W.A.	T.D.E.
Jill Johnston	Girl Guides	Girl Guide Leaders
Mathew James	Space Assoc. of Aust.	Space Association
E. Justins	W.A.Inst. of Technology	Home Economist
M. Jones	W.A. Education Dept.	Reproductive Health
L. Jubbs	" " "	Teacher Librarians
Trevor Jonnich	Vic. Police	National Police
Rod Jewel	Norwood High School	Computers
Andrew Kefalianos	Morialta High School	Computers
Philip Jenkin	S.A.College of Adv.Ed.	T.D.E.
Simone Kirk	Girl Guides	Girl Guide Leaders
Ray Keane	Gisborne Golf Club	Turf Culture
M. Kilminster	W.A.Inst. of Technology	W.A.I.T. Tutorial
David Kember	Tas.College of Adv.Ed.	T.D.E.
Andrew Kellaher	S.A.College of Adv.Ed.	S.P.C. News
John Kevin	S.A.College of Adv.Ed.	S.P.C. News
Dr.Mary Lush	Turf Research Institute	Turf Culture
Geoff Lawson	Telecom Australia	Library Association
Kelly Lynch	Girl Guides	Girl Guide Leaders
John Lawrence	The Age	P.I.N.A.
E. Langrange	W.A.Inst. of Technology	Home Economists
Dr.P.Layzell-Ward	" " " "	Teacher Librarians
Dr.Jim Lange	University of W.A.	T.D.E.
E.Lucas	W.A.Education Dept.	Ed.Totally Dependent
Dr.G.Leavesley	Family Planning Assoc.	Reproductive Health
H. Leader	Aust. Red. Cross	Red Cross
Dr. Kevin Livingston	Darwin Comm. College	T.D.E.
Lois Medlin	Girl Guides	Girl Guide Leaders
Christina Melaluka	Nuclear Disarmament	Low-Level Radiation
Michael Muir	Space Assoc.of Aust.	Space Association
Michael Menley	Space Assoc.of Aust.	Space Association
Pam Murison	Girl Guides	Girl Guide Leaders
Joan Moors	Girl Guides	Girl Guide Leaders
Linda Marson	Radio 3CR	P.B.A.A.
Dr.J.Malone	W.A.Inst. of Technology	W.A.I.T.Tutorial
A. Martins	W.A.Inst. of Technology	Nursing Education
P. Maggiore	" " " "	Home Economists
T. Mendelsohn	Family Planning Assoc.	Reproductive Health
B. Mathews	Y.W.C.A.	Y.W.C.A.
T. Menzies	N.T.Cartographers Assoc.	W.A.I.T.Tutorial
Ross Mezger	Tas.College of Adv.Ed.	T.D.E.
Murray Masterton	S.A.College of Adv.Ed.	P.I.N.A.
Barbara Mosley	Nursing Mothers Assoc.	Breast Feeding
Mary McGill	Dept. of Communications	Library Association
Alan McLean	Australian Red Cross	Red Cross
Gracemary McKinnon	Soroptimists International	Soroptimists International
R. McCartney	Turf Research Institute	Turf Culture
Pat McCully	Girl Guides	Girl Guide Leaders
Naomi McNamara	Girl Guides	Girl Guide Leaders
Pat McArdell	Aust.Information Service	Red Cross
Helen McIntosh	Curriculum Program	N.C.F.Y.S.
Vicky Nicholson	Maunsell & Partners P/L	Library Association
D. Newman	N.T.Library Association	Library Association
Jill Nicholls	Darwin Comm. College	T.D.E.
Tom Noonan	Queensland Police	National Police
Paul Northcott	Deakin University	T.D.E.
Jeff Nankivell	Rotary Club	Rotary International
M. O'Loughlin	W.A.Inst. of Technology	W.A.I.T. Tutorial
F. O'Sullivan	W.A. Education Dept.	Early Childhood

J. Oakley	Y.W.C.A.	Y.W.C.A.
E. Oberleuter	Darwin Comm. College	T.D.E.
Geoff Osborne	Turf Association	Turf Culture
Ray O'Grady	N.S.W. Police	National Police
Clive Popham	La Trobe University	Turf Culture
Rob Pardy	Youth Affairs Council	Pacific Youth Link
M.Pennington	Ex Local Guide Assoc. Advisor	Girl Guide Leaders
B. Prentice	Girl Guides	Girl Guide Leaders
W. Powel	Turf Association	Turf Culture
C. Penter	W.A. Education Dept.	Reproductive Health
D. Pollock	Australian Red Cross	Red Cross
Michael Parer	Gippsland Inst. of Advanced Education	T.D.E.
John Parish	Dept. of Agriculture	Turf Culture
Brian Poulter	Vic. Police	National Police
Ray Petersen	Urbrae Agricultural H.S.	W.A.I.T. Tutorial
Mary Raiskum	Deir-Tivoli Court	Library Association
Dr.Hamish Russel	Dept.of Agriculture	Agriculture Exchange
Hazel Riordan	Girl Guides	Girl Guide Leaders
Dixon Robinson	F.H.Brunning Pty.Ltd.	Turf Culture
Dr.Hamish Russel	Dept.of Agriculture	A.P.R.I.N.
Wendy Rose	Y.W.C.A.	Y.W.C.A.
Mike Rosel	Aust.Information Service	Red Cross
Dr.D.Reid	W.A.Inst. of Technology	Computers
P. Rebakis	" " " "	Computers
P. Robinson	" " " "	W.A.I.T. Tutorial
B.Richardson	N.T. Education Dept.	Ed.Totally Handicap
Dante Roccisano	S.A.College of Adv.Ed.	W.A.I.T. Tutorial
Richard Smiley	Plant Research Institute	Turf Culture
Olly Schofield	Youth Affairs Council	Pacific Youth Link
Leon Stubbings	Australian Red Cross	Red Cross
Steve Seumahu	La Trobe University	A.P.R.I.N.
" "	" " "	T.D.E.
Doris Spratling	Girl Guides	Girl Guide Leaders
Doris Storey	Girl Guides	Girl Guide Leaders
Steve Seumahu	La Trobe University	PEACESAT CONSORTIUM
Helen Searle	Uniting Church	Boys Brigade
Steve Seumahu	La Trobe University	PEACESAT Executive
" "	" " "	PEACESAT Committee
P. Stephens	W.A. Inst. of Technology	T.D.E.
Dr. K. Sauer	" " " "	Home Economist
Dr. J. Sharpham	" " " "	Drama in Education
Peter Seaman	University of W.A.	T.D.E.
Dr.M.Smith	W.A.College of Adv.Ed.	T.D.E.
C.Silvert	Aust. Red Cross	Red Cross
W. Shakespeare	" " "	Red Cross
J. Suiter	N.T.Library Association	Library Association
Barbara Smith	South Bunbury P.S.	Teacher Librarian
Brian Shaw	Darling Downs I.A.E.	T.D.E.
Dr.Maureen Smith	University of W.A.	T.D.E.
Geraldine Stevens	W.A.Nuclear Disarmament	W.I.L.P.F.
Carol Steele	Nursing Mothers Assoc.	Breast Feeding
Peter Smith	Deakin University	T.D.E.
Tony Stanicic	W.A. Police	National Police
Jocelyn Suiter	S.A.College of Adv.Ed.	Library Association
David Turnbull	Boys Brigade	Boys Brigade
Elizabeth Thompson	Girl Guides	Girl Guide Leaders
Dr.D.Treagust	W.A.Inst. of Technology	W.A.I.T. Tutorial
E. Turvey	Y.W.C.A.	Y.W.C.A.
Neil Trainor	Footscray Inst. of Tech.	T.D.E.
Nguyen Tran	Deakin University	T.D.E.
Marjorie Taylor	Soroptimists	Soroptimists International
Paul Tippett	Regency Park College T.A.F.E.	W.A.I.T. Tutorial
Andrew Tinker-Casson	Norwood High School	High School

S. Vlahov	W.A.Inst. of Technology	W.A.I.T. Tutorial
John Vernon	City Beach Bowling Club	Turf Culture
June Warners	Girl Guides	Girl Guide Leaders
Marjorie West	Girl Guides	Girl Guide Leaders
Linda Wilkinson	Girl Guides	Girl Guide Leaders
Dion Weston	Radio 3RRR-FM	P.B.A.A.
Jenny Walsh	W.A.Inst. of Technology	T.D.E.
A.White	W.A.Inst. of Technology	T.D.E.
M.White	" " " "	T.D.E.
B.White	" " " "	Computers
Dr.R.Weiland	W.A.Education Dept.	Ed.Totally Dependent
J.Wotherspoon	Darwin Community College	Nurses Education
Niall Wilmott	W.A.State Emergency Service	Vulcanology
Gwen Waiwright	Soroptimists	Soroptomists International
Claire Woods	Girl Guides	J.O.T.A.
Bob White	W.A.State Emergency Service	Vulcanology
Charles Weyne	Vic. Police	National Police
J. Wall	Tas. Police	National Police
Kim Williams	W.A. Police	National Police
Sandra Webb	Nursing Mothers Assoc.	Breast Feeding
J. Young	Y.W.C.A.	Y.W.C.A.
Ivy Youngberry	Darling Downs I.A.E.	T.D.E.
J. Zanden	Murdoch University	T.D.E.
Margaret van Ruth	Project Officer, Special Education	Educational Programmes for Totally Dependent children.
Helen Yandell	Director, Gullywinds Centre	" "
Pat Gleed	Director, Seawinds Centre	" "
Peter Johnstone	Principal, Woodville Spastic Centre	" "
Dr. Keith Were (And about 15-20 participants in the sessions.)	Director, Special Education	" "
Sister Ella Tyler	Red Cross	Red Cross
Dr. John Gerofi	McQuarie University	A.P.R.I.N.
Don McDonald (and numerous scouts, guides)	Boy Scouts Association of S.A.	J.O.T.A.
Pam Walter	Girl Guides Association	Guide Leaders
School Class	Sturt Street Primary School	Student Exchange
University Student Group	Adelaide & Flinders Universities	French Conversation with Noumea
School Class	Walford Church of England Girls Grammar School	Student Exchange
School Class	Calvery Lutheran School	Student Exchange
School Class	Nailsworth Primary School	Student Exchange
School Class	Asquith Girls School, Sydney	Student Exchange
School Class	Port Adelaide Girls High School	Student Exchange
School Class	Mater Christi Catholic School	Student Exchange
School Class	Victor Harbour Primary School	Student Exchange
School Class	Rosary Catholic School	Student Exchange
School Class	Modbury Special School	Student Exchange
School Class	St. John Bosco Catholic School	Student Exchange
Bob Jenssen	Rotary Club of Burnside	Rotary International
Jack Harris	C.S.I.R.O.	Turf Culture
Dean Goldsack	President, South Australian Golf Course Superintendents Association	" "

Professor H. Wallace	Plant Pathology Dept., Waite Agricultural Research Inst.	Turf Culture
George Pfeiler	Adelaide & Wallaroo Fertilizers	" "
Murray Hughes	C.S.I.R.O.	" "
Kevin Handreck	C.S.I.R.O.	" "
Carmel Clancy	Catholic Family Planning Authority	Natural Family Planning
Heather Crosby	Y.W.C.A. Executive, Adel.	Y.W.C.A.
Lt. Robin Grant	Royal Australian Navy, Canberra	Ocean Politics & Law
Lindsay Cleland	Australian National Library Canberra	Pacific Archives
Mary Whitehead (and about 20 other participants)	Soroptomists International (S.A.)	Soroptimists International
John Saunders	Croydon Park Community College	T.A.F.E. exchanges
Vic Barnes	Gilles Plains Community College	T.A.F.E exchanges
Shane Rees	Dept. of Youth Affairs, Canberra	CYP/Pacific Youth
Helen Briggs	" " "	" " "
Hal Judge	" " "	" " "
Linda Garner	" " "	" " "
Clem Latz	Australian Society for Educational Technology	A.S.E.T.
Chris Larsen	Educational Technology Centre	Foreign Language Seminar
John Haynes	Special Education, Educ. Dept. of S.A.	Equipment for Disabled
Chris Goodwin	Experimental Art Foundation	Experimental Art
Tom Klinkowstein	Visiting Artist/Lecturer	" "
Steve Cramond	Libraries Assoc. of Australia	Librarians Conf.
Christine Lawrence	Curriculum Development Centre, Canberra	TOP Project
Heather Crosby	Y.W.C.A.	Pacific Health
Bob Haynes	University of Adelaide	Interactive Video

10. GROUND STATION EQUIPMENT

10.1 TRANSMITTERS

- Transmitting Section of AZDEN PCS-3000 Transceiver (e.g. LA TROBE, LA TROBE-PORTABLE, MAGILL, DARWIN, TAMAR HOUSE, LEEDERVILLE)
- Transmitting Section of AZDEN PCS-4000 Transceiver (e.g. KATHERINE, EDUCATION-PORTABLE, DEAKING-GEELONG, ALICE SPRINGS, MOSMAN)
- Transmitting Section of PCM 351 Transceiver (e.g. ADELAIDE, ADELAIDE-PORTABLE)
- Transmitting Section of KIMBERLEY RFK 102 Transceiver (e.g. PERTH, BENTLEY, BUNBURY, ALBANY)
- Transmitting Section of TAIT MINIPHONE T 198 Transceiver (e.g. TOOWOOMBA, ADELAIDE POLICE, LAUNCESTON)
- Transmitting Section of AWA 25C Carphone (e.g. COLLINGWOOD, CARNARVON)
- Transmitting Section of PHILIPS 828 Transceiver (e.g. MAYLANDS, WINNELLIE)
- MOTOROLA C 73 RCB (e.g. FOOTSCRAY)
- Transmitting Section of WILLIS H4 Transceiver (e.g. BRISBANE)
- Transmitting Section of MAXAR 80 (Modified) Transceiver (e.g. WESTON)
- Transmitting Section of WESTON X 551 H Transceiver (e.g. HOBART)

10.2 POWER AMPLIFIERS

- TONO MR-250W (e.g. LA TROBE, LA TROBE-PORTABLE, PERTH, BENTLEY, KATHERINE, EDUCATION-PORTABLE, BUNBURY, WESTON, DEAKIN-GEELONG, HOBART, TAMAR HOUSE, ALBANY, ALICE SPRINGS, LEEDERVILLE, ADELAIDE-POLICE)
- MIRAGE B 1016 (e.g. LA TROBE, ADELAIDE, ADELAIDE-PORTABLE)
- LUNAR 2M25-150 (e.g. LA TROBE, TOOWOOMBA, MAGILL, DARWIN, MOSMAN, SYDNEY)
- DRESSLER D200S (e.g. LA TROBE)
- TONO MR-150W (e.g. WARILLA, MAYLANDS)
- HOME MADE (e.g. COLLINGWOOD, CARNARVON, BRISBANE)

10.3 TRANSMITTING ANTENNAS

- 7-turn Helix, 60cm diameter, 4m length (e.g. LA TROBE)
- 10-turn Helix, 70.5cm diameter, 4.7m length, (e.g. TOOWOOMBA)
- 8-turn Helix, 66cm diameter, 4m length (e.g. MAYLANDS, WINNELLIE, BRISBANE)
- 10-turn Helix, 66cm diameter, 6m length (e.g. BENTLEY, BUNBURY)

- 10-turn Helix, 64cm diameter, 5 m length (e.g. DEAKIN-GEELONG)

- 8-turn Helix, 70cm diameter, 3.8m length (e.g. HOBART)

- 10-turn Helix, 60 cm diameter, 5.1m length (e.g. ALBANY)

- Cross Yagis of 9 to 11 elements, 2.5m to 4m length (e.g. LA TROBE-PORTABLE, ADELAIDE, ADELAIDE-PORTABLE, PERTH, COLLINGWOOD, MAGILL, DARWIN, KATHERINE, EDUCATION-PORTABLE, WESTON, DEAKIN-GEELONG, TAMAR HOUSE, ALICE SPRINGS, LEEDERVILLE, ADELAIDE POLICE, MOSMAN, CARNARVON)

10.4 RECEIVING ANTENNAS

- 7-turn Helix, 60cm diameter, 4m length (e.g. LA TROBE)

- 10-turn Helix, 70.5cm diameter, 4.7m length (e.g. TOOWOOMBA)

- 8-turn Helix, 66cm diameter, 4m length (e.g. MAYLANDS, WINNELLIE, BRISBANE)

- 10-turn Helix, 66cm diameter, 6m length (e.g. BENTLEY, BUNBURY)

- 10-turn Helix, 64 cm diameter, 5m length (e.g. DEAKIN-GEELONG_

- 8-turn Helix, 70cm diameter, 3.8m length (e.g. HOBART)

- 10-turn Helix, 60cm diameter, 5.1m length (e.g. ALBANY)

- Cross Yagis of 9 to 11 elements, 2.5m to 4m length (e.g. LA TROBE-PORTABLE, ADELAIDE, ADELAIDE-PORTABLE, PERTH, COLLINGWOOD, MAGILL, DARWIN, KATHERINE, EDUCATION-PORTABLE, WESTON, DEAKIN-GEELONG, TAMAR HOUSE, ALICE SPRINGS, LEEDERVILLE, ADELAIDE POLICE, MOSMAN, CARNARVON)

- Linear Yagi, 11 elements, 3.5m length, twistable (e.g. LA TROBE)

10.5 RECEIVING PRE-AMPLIFIERS

- Pre-amplifier Section of TONO MR-250 Power Amplifier (e.g. LA TROBE, LA TROBE-PORTABLE, PERTH, BENTLEY, KATHERINE, EDUCATION-PORTABLE, BUNBURY, WESTON, DEAKIN-GEELONG, HOBART, TAMAR HOUSE, ALBANY, ALICE SPRINGS, LEEDERVILLE, ADELAIDE POLICE)

- Pre-amplifier Section of MIRAGE B1016 Power Amplifier (e.g. LA TROBE, ADELAIDE, ADELAIDE-PORTABLE)

- Pre-amplifier Section of LUNAR 2M25-150 Power Amplifier (e.g. LA TROBE, TOOWOOMBA, MAGILL, DARWIN, MOSMAN, SYDNEY)

- Pre-amplifier Section of TONO MR-150W Power Amplifier (e.g. WARILLA, MAYLANDS)

- LUNAR PAG-144 (e.g. LA TROBE, LA TROBE-PORTABLE, MAGILL, KATHERINE, EDUCATION-PORTABLE, TAMAR HOUSE, ALICE SPRINGS, MOSMAN)

- LUNAR PAG-137 (e.g. FOOTSCRAY, SYDNEY)

- Modified LUNAR PAG-144 (with MPE 210 transistor (e.g. DEAKIN-GEELONG)

- TV Mast-Head Amplifier (e.g. BRISBANE)

- Home Made (e.g. PERTH, COLLINGWOOD, WINNELLLIE, WESTON, CARNARVON)

10.6 RECEIVERS

- J.I.L. SX-200 Scanning Receiver (e.g. LA TROBE, LA TROBE-PORTABLE, MAGILL, DARWIN, KATHERINE, EDUCATION-PORTABLE, DEAKIN-GEELONG, TAMAR HOUSE, ALICE SPRINGS, LEEDERVILLE, MOSMAN)

- YAESU FRV-7700 Convertor Plus FRG-7700 Communications Receiver (e.g. LA TROBE)

- Receiving Section of PCM 351 Transceiver (e.g. ADELAIDE, ADELAIDE-PORTABLE)

- Receiving Section of KIMBERLEY RFK 102 Transceiver (e.g. PERTH, BENTLEY, BUNBURY, ALBANY)

- Receiving Section of TAIT MINIPHONE T198 Transceiver (e.g. TOOWOOMBA, ADELAIDE POLICE, LAUNCESTON)

- Receiving Section of AWA 25C Carphone (e.g. COLLINGWOOD, CARNARVON)

- Receiving Section of PHILIPS 828 Transceiver (e.g. MAYLANDS, WINNELLIE)

- MOTOROLA 201 C6 (e.g. FOOTSCRAY)

- Receiving Section of WILLIS H4 Transceiver (e.g. BRISBANE)

11. MISCELLANEOUS ITEMS RELATING TO CURRENT ACTIVITIES

11.1 EDUCATIONAL TECHNOLOGY CENTRE'S ATS-1 ACTIVITIES DURING 1983

11.2 TERTIARY DISTANCE EDUCATION SUB-NET AND ASPESA FORUM, JULY 1983

11.3 INTRODUCING W.A.I.T. DISTANCE EDUCATION NETWORK

11.4 SCOUTS JAMBOREE ON THE AIR 1983

11.5 THE NORTHERN TERRITORY EXTERNAL STUDIES CENTRE

11.6 A BRIEF HISTORY OF DATA EXPERIMENTS AT THE MAGILL SITE of S.A.C.A.E.

11.7 W.A. FLASHBACK TO 1963

11.1 EDUCATIONAL TECHNOLOGY CENTRE'S ATS-1 ACTIVITIES DURING 1983

Barry Germein
Educational Technology Centre, Adelaide
AX 33

During 1983 the Educational Technology Centre, through its AX33 and AX78 portable terminals has been very active in its use of the ATS-1 satellite.

Our involvements have comprised more than 300 hours of "On Satellite" time, as shown below.

Student - Student Exchanges	15 hours
Community Sessions	61.25 hours
Academic/Professional Discussions	60.25 hours
Data Transmission	59.25 hours
Scheduling (Peacesat & Kangaroo Net)	62 hours
Message Sessions	68 hours
Total	325.75 hours

In addition, AX33, through its responsibility as co-ordinator of the Primary/Secondary Education Subnet, has opened and monitored the 0100 timeslot more than 100 times when it was not scheduled for a specific use.

Apart from its regular commitments to scheduling, messages and subnet co-ordination, AX33 has pursued its objectives of investigating ways in which satellite communications may support our work in distance education and developing suitable methodologies for satellite use.

We have made the terminal accessible to various groups in the community, enabling Adelaide people to become involved in the activities of the Pacific region, and generating considerable interest in satellites and their potential.

There has been during 1983 an increased awareness of the potential for information sharing via satellite. This is evidenced by the large number of academic and professional discussions involving Adelaide. Three areas which have become particularly active are Foreign Language Teaching, Equipment for the Disabled and Educational Programmes for Totally Dependent Children.

The development of a data transmission capacity via satellite using computers is very exciting and we have been involved within the limits of our technical and computer expertise. This communications medium holds great promise, particularly in its use as an electronic mailbox. We will be continuing to explore other data transmission possibilities, including Videotex transmission.

The methodology of student group to student group exchanges has now been well developed and we have conducted many successful sessions with other terminals in the ATS-1 networks. The use of both the portable unit (AX78) and AX33 (via studio and phone patch) has enabled us to learn successful techniques and develop appropriate support equipment. This will be documented and circulated during 1984.

AX33 Adelaide has enjoyed the support and encouragement of the other Kangaroo Net members throughout the year and we look forward to further involvement with ATS-1 in 1984.

11.2 TERTIARY DISTANCE EDUCATION SUB-NET AND ASPESA FORUM, JULY 1983

Dr. Kevin Livingston

N.T. External Studies Centre, Darwin

AX 34

During the 7th Biennial Forum of the Australian and South Pacific External Studies Association (ASPESA) held at the Darling Downs Institute of Advanced Education at Toowoomba, Queensland, from Monday 11th - Friday 15th July 1983, a teleconference was held via ATS-1 each day during the 0600-0800 USPNET time slot. Planning for these scheduled sessions took place over the weeks preceeding the Forum - during the Tertiary Distance Education sessions held on Wednesdays and Fridays on Kangaroo Net at 0500. These planning sessions were co-ordinated by Kevin Livingston (Darwin) and George Idle (WAIT - Bentley).

The topics covered during the three Forum teleconferences were:

1. Tuesday 12 July: 'Satellite Telecommunications in Distance Education' - presenters Alistair Inglis (DDIAE), George Idle (WAIT) and Steve Seumahu (La Trobe).

2. Wednesday 13 July: 'Library Services for Distance Students' - presenters Margaret Cameron (of Deakin University, speaking from Darwin terminal), Andrew Winter (Deakin) and Christine Crocker (Uni. of Queensland).

3. Thursday 14 July: 'The Future of Distance Education in Australia and the South Pacific' - presenters Dr. Milo Shott (1983 ASPESA Fellow on leave from the British Open University); and Professor Don Bewley (Massey University, N.Z.). Participants joined in these teleconferences from the following terminals: Bentley (WAIT); Magill (SACAE); La Trobe; Darwin; Suva, Niue and Toowoomba.

In addition to these teleconferences there were two afternoon discussion sessions on the Forum programme, under the general title of 'Technology'. Canadian and Australian participants spoke to papers which had been published and circulated in the two volumes of the pre-conference Collected Papers published by DDIAE Press (May 1983) for ASPESA.

There was considerable discussion about possible uses of AUSSAT for education at a distance during these discussion sessions.

Finally, the Darwin and Bentley co-ordinators of the Tertiary Distance Education Sub-net on the KANGAROO Network took the opportunity to invite present and potential users of ATS-1 and AUSSAT to an information - sharing session after lunch on Thursday 14 July. There was a lot of interest shown in the present scheduled activities on ATS-1. Representatives from a number of tertiary institutions informed the meeting that they expected to join KANGAROO NET in the near future.

Since the Forum there has been further discussion of AUSSAT and its potential for tertiary distance education during the regular 0500 Friday seminars on KANGAROO Net.

11.3 INTRODUCING W.A.I.T. DISTANCE EDUCATION NETWORK

Alf Debnam

Western Australia Institute of Technology

AX 83

AX83 BENTLEY joined the Kangaroo Network in its inaugural broadcast link with AX34 DARWIN and AX38 LATROBE on 18th May 1983. The Bentley satellite station is on the campus of the Western Australian Institute of Technology some 10 km S.E. of Perth city centre. WAIT is a multi-disciplinary College of Advanced Education with over 2000 of its students studying in the external mode across all academic Schools with a predominance in the areas of business, social science, teacher education and the applied sciences. The satellite station is a joint project of the School of Electrical and Electronic Engineering and the Centre for External Studies and Continuing Education. The operators are Mr. George Idle (station coordinator, and Head of External Studies) and Mr. Alf Debnam (an academic staff member in External Studies).

On 11th August 1983 WAIT's second satellite station began operating. This is AX85 BUNBURY, situated at WAIT's Bunbury Advanced Education Centre about 180km south of Perth on the coast. The operator is Mr. Doug Parry.

Future satellite stations are planned at a number of centres throughout Western Australia, including AX84 at Kalgoorlie in the goldfields some 600 km east of Perth.

Already WAIT students around Australia have been "on the satellite" for tutorials in science education and business studies. WAIT, too, has involved a number of people from community organizations in PEACESAT teleconferencing programs and is keen to develop this aspect along with its more academic roles of servicing external students, discussing and experimenting with other distance education institutions in Australia and the Pacific, training of academic staff in the use of the satellite, and involving specialist academics (especially scientists) in specific PEACESAT programs.

Planning for a computer link is also well advanced.

For those with technical interests, AX83 BENTLEY has a helix antenna with 10 turns around a central aluminium rod. In the satellite room is a combined transceiver (Kimberley 102) with external pre-amp. combined with the TONO MR - 250W transmitter power amplifier. It has an output power of 200 watts. This technical information by courtesy of Mr. Paul Stephens, Lab. Manager in the School of E. & E.E.

Equipment for both Kalgoorlie (AX84) and Albany (awaiting Licence - AX86?) has been tested and excellent signals were obtained. These stations should be operating in December '83 or early in 1984. Kalgoorlie is located at the W.A. School of Mines, which is a branch college of the W.A. Institute of Technology situated some 600 km East of Perth. The Albany terminal is located at the Albany Technical College some 400 km SE of Perth on the southern coast. Terminals are also planned for Collie, Geraldton and other W.A. country towns.

11.4 SCOUT JAMBOREE ON THE AIR

Dr. V. Nguyen Tran

Deakin University, Geelong

AX 200

On 15 October, 1983, Deakin-Geelong was privileged to play host to a number of scouts in the Geelong region who took part in the jamboree of the air involving a great number of scouts in Australia and the pacific regions.

For the scouts who came to Deakin, it was quite an experience to be able to talk to others some 72,000 km away. Everyone was eager to have an opportunity to talk, to exchange views, to send greetings or to swap badges.

The reception from Lae was clear and almost 5/5 which was different from previous receptions. Everyone was sad to learn about the flood in Lae. The Scout group in Rarotonga came in and sang some songs which were very enjoyable. Scout groups and girl guides in Australia including: Geelong, Adelaide, Perth, Catherine etc... were busy exchanging addresses. Earlier on in the day, the Governor General speech was broadcast over the satellite. However, the relay from La Trobe AX 38 was not very good. This was not because of the La Trobe terminal, it was the quality of the HF reception and there was not much La Trobe could do to rectify the situation. In future events, it may be a good idea to have a direct link to the Governor General in order to avoid any disappointment which is caused by the conversion from the HF to satellite network.

Overall, the jamboree of the air seemed to be a great success and everyone taking part seemed to have enjoyed the unforgettable event.

11.5 THE NORTHERN TERRITORY EXTERNAL STUDIES CENTRE

HOST OF TERTIARY DISTANCE EDUCATION SUB-NET

Coordinator: Dr. Kevin Livingstone

AX 34

The Northern Territory External Studies Centre was established in late 1982, following recommendations from the Commonwealth Tertiary Education Commission. The Centre is located in new premises at the Darwin Community College, Casuarina Campus

The Centre has been set up to provide information and services to Northern Territory residents seeking or under-taking external courses with tertiary institutions located outside the Territory.

RESOURCES AND FACILITIES

*A staff of three people-the Co-ordinatory, the Examination Officer and the Administrative Assistant.
*A collection of information sources from Australian colleges,institutes and universities providing external studies.
*Access to a well-appointed seminar room, equipped with video-cassette recorder and other teaching aids.
*A record-a-phone telephone for recording messages and enquiries after hours.
*Access to a loud-speaker telephone and a voice satellite network for teletutorials.

SERVICES

*Providing information and guidance on external courses available from advanced colleges, institutes and universities, Australia-wide.

*Counselling new and prospective external students on study skills.

*Helping external students to register with the Learning Resources Centre (Library), the Computer Centre and the Counselling Centre of the Darwin Community College.

*Responding to the needs of individual students by facilitating administrative or tutorial arrangements and communications with other institutions.

*Helping external students to form study groups.

*Negotiating with other institutions to provide tutorial assistance and practical or laboratory sessions locally.

*Co-ordinating the supervision of examinations.

*Arranging teletutorials for Northern Territory students.

*Providing a venue for visiting staff conducting tutorials and workshops for their Northern Territory students.

COLLEGES, INSTITUTES AND UNIVERSITIES

The following advanced colleges, institutes and universities have contacted the Centre regarding services to their enrolled or prospective students.

ADVANCED COLLEGES AND INSTITUTES

*Armidale College of Advanced Education
*Brisbane College of Advanced Education
*Capricornia Institute of Advanced Education
*Darling Downs Institute of Advanced Education
*Gippsland Institute of Advanced Educatio
*Mitchell College of Advanced Education
*Newcastle College of Advanced Education
*Northern Rivers College of Advanced Education
*Orange Agricultural College
*Royal Melbourne Institute of Technology
*Queensland Agricultural College
*Queensland Institute of Technology
*Riverina College of Advanced Education
*South Australian College of Advanced Education
*Warrnambool Institute of Advanced Education
*Western Australian College of Advanced Education
*Western Australian Institute of Technology

UNIVERSITIES

*Deakin University
*James Cook University
*Macquarie University
*Murdoch University
*University of New England
*University of New South Wales
*University of Queensland

For reports on some activities initiated from Darwin in 1983, see the articles in Kangaroo Network Bulletin, August 1983.

Darwin's major contribution has been to co-ordinate - through the Northern Territory External Studies Centre at the Darwin Community College - the twice weekly sessions of the Tertiary Distance Education Kangaroo sub-net: the administrative Wednesday sessions: (officially 0500-0530, though for most of 1983 the whole hour was available and sometimes used); and the Friday seminar series - on applications of telecommunications to distance education - from 0500 to 0600 hours. From March to June the weekly seminar sessions were used for forward planning and to plan for the Biennial Forum of the Australian and South Pacific External Studies Association held in Toowoomba in July.

From July to December more formal seminars were held with prearranged agendas, presenters and general discussion papers circulated. Transcripts of the sessions were prepared and circulated from the Bentley (WA) terminal to a mailing list of about 40 people in mainly Australian, New Zealand and South Pacific tertiary institutions. In the second half of 1983 there were regular participants from nine Australian Tertiary institutions as well as from Massey University (NZ) and the University of the South Pacific (Fiji Campus).

11.6 A BRIEF HISTORY OF DATA EXPERIMENTS AT THE MAGILL SITE OF S.A.C.A.E.

Peter Spooner M.A.I.E.S. T.O.C.P.

AX 82

My interest in data transmission began while listening to the experiments between Guam, HIGCOM, Pago Pago, Suva and Wellington. Being curious about the coding method used I tried storing the carrier on an oscilloscope. As Murphy would have it I stored a noise distortion pulse right in the middle of the signal so that looking at the displayed waveform I assumed phase shift keying was being used. After discussing this with the data originators I had second thoughts and tried to store the signal on the oscilloscope again. With careful measurement of frequency I then realized it was frequency shift keying and was about 1300Hz shifting to a lower frequency for the mark duration. Searching data books for a suitable phase lock loop I came across a circuit that also listed the standard frequencies as 1270 space and 1070 mark.

Building the circuit up and running a tape taken from the satellite I was able to get digital signals from the circuit. Stored away in a cupboard I had a video terminal I had built about two years ago. Connecting the detector curcuit to the terminal all I could see on the screen were @'s, deletes, line feeds and blanks. Asking Suva about the data coding and telling of my results, I was told it was ASCII. Trying different stop bit and parity configurations gave no change in results. Trying a different tack I went back to the demod circuit. With the oscilloscope I eventually found I was only detecting the start and stop bits, hence the @'s and deletes (ASCII 64 & 127). Modifying the circuit by adding an adjustable detect level resulted in detection of all bits of the data train.

Thus I was now able to read the data on the screen. One problem I had was the returns were not line feeding and part of each line was being overwritten and there were less characters on my display than on the originators, but if I read as it was, writing all could be understood. The next stage was to get a hard copy of the data. Asking Robert Goodwin if he could spare a printer, he gave me a loan of a printing terminal which fortunately would connect with my 20ma current loop terminal. Connecting the receive loop in series with the video terminal I was now able to read the screen and print simultaneously. However I found I had to line feed by hand (sometimes too late) while printing as each return caused the printer to start again over the last line, for longer lines this was easy enough but short lines of a couple of words invariably beat me.

The next week I was able to receive the new schedule from Guam direct off the satellite with only minor errors due to noise on reception. This was certainly good news as our order for a micro modem would take some months. However I could not transmit data. A little nutting out provided a simple low cost answer with a one chip oscillator having a transister switching in additional timing resistance. A twin T filter converted the squarewave output to a sinewave acceptable to send over the satellite. Connecting the keyboard output of the video terminal to this modulator and then back into the demodulator gave a correct printout and display.

Next problem was to transmit the data. The only immediate solution was to tape record the signal and acoustically couple it by holding the microphone against the recorder speaker. One finger typing a message onto the recorder and then playing it back worked although slow at my speed of

typing. Asking a typiste to type in the message was a lot quicker so I arranged for Margaret Parsons, the Dean of faculty's secretary, to type my verbal message onto the tape recorder about an hour before the computer session during which I hoped tc try and send text. Despite the awkwardness of the keyboard Margaret achieved results with only a couple of double strikes. The taped message was completed with 15 minutes to spare before the Friday 0100 computer session. About halfway through the session the participants were awaiting Magill's first transmission of data. Not having tried the method I did not know what volume to use but used a louder setting of the recorder and held it about one inch above the speaker. A test run of the first few lines confirmed the data was received at most terminals although not accurately enough for all stations. The tape was then rewound and run through to the end, very tiring on the mike hand. Data was confirmed from most terminals and the comments were that it was more readable than voice under the prevailing conditions.

The next attempt at a longer message was a short report of overseas study from the college magazine. For this I recruited the college's typing lecturer for some speed typing. When it came to sending the recorded tape however, it was too slow (real time) to send the whole text and the power amplifier over heated so I resolved not to use this method again because of the slowness, indeed Jim Lange tried receiving on 110 baud because of the slow rate of transmission.

Adapting my built up modem to include connection to the college's main computer via a terminal outlet run to my office would now enable me to send data direct from the main computer to the satellite users. In the first week of May the first signal from the main computer went to air, the log-in listing and college computer listing index. Next I used the text editor to assemble an official computer message for participants invitations to a coming satellite session. This was sent direct from the main computer early in June and received by Ed Houlten at H.I.G.COM with some errors, it was sent again so Ed could use his error correction program on it.

The main computer is now used for regular computer to Pacific terminals. Computer programs from students of nearby high schools have been sent to summer school computer camps run by John Southworth in Honolulu successfully.

11.7 W. A. FLASHBACK TO 1963

Alf. Debnam

Western Australian Institute of Technology

AX 83

In a link-up on the Kangaroo Net on 12th July 1983, Mr. Henry Court, a visitor to the Bentley station from the Nedlands campus of the W.A. College of Advanced Education, provided the net with an account of an interesting precursor of the satellite age. In 1963 he was a teacher at Richmond Primary School in East Fremantle WA. The present Director of the W.A. College of Advanced Education, Dr. Doug Jecks, was reading for his PhD at Columbia University, North America, and arranged for elementary year 6 school children in a local Canadian school to speak via land line and radio telephone with the year 7 children at Richmond. The P.M.G. Department (now Telecom) installed a phone in the classroom. Children were prepared for the program with a patriotic song and many questions. When the call came through it was amplified to the whole school by an ingenious method devised by a skilled teacher, Mr. Charles Simpson. As Mr. Court notes, "I believe the line of communication was land line from Columbia to San Francisco, radio telephone on to Auckland, undersea cable from NZ to Sydney, then overland from Sydney to Perth via Melbourne and Adelaide. Each exchange had to contact the next to obtain a hook-up. A strange sensation was the time lapse between when a speaker on one continent concluded and when the speaker on the other continent responded. This was the first inter-continental educational communications exchange, and high hopes were held for more cultural interchange leading to development of tolerance and understanding".

Those sanguine expectations clearly are being fulfilled on our PEACESAT Network.

12. SAMPLE PLANS FOR 1984

12.1 INTERNATIONAL TRAINING INSTITUTE AND ITS PLAN FOR USE OF ATS-1

12.2 UNIVERSITY OF QUEENSLAND'S PLANS FOR USE OF ATS-1

12.3 CAPRICORNIA INSTITUTE OF ADVANCED EDUCATION'S PLANS FOR USE OF ATS-1

12.4 ALBANY TECHNICAL COLLEGE'S PLANS FOR USE OF ATS-1

12.1 INTERNATIONAL TRAINING INSTITUTE AND ITS PLAN FOR USE OF ATS-1

Keith Jackson,

Media Section.

The International Training Institute, located at Middle Head, Sydney, Australia, provides short, intensive courses for men and women from developing countries as part of Australia's Development Assistance Program. These courses are intensive in nature and operate over a 12 week period. Course Participants receive an award from the Australian Government to cover the costs of their training in Australia. This includes accommodation, travel and a living allowance.

The Institute's courses emphasise the development of particular skills but "training" is given a much broader and richer meaning than normal. Courses are designed to enable course members to increase their understanding of why their work is important in their country's development and how the acquisition of knowledge and skills can aid the development process.

The number in each course group is usually fifteen. Course participants are selected from a number of countries except on those occasions the Institute offers a course for a specific country. This provides a truly international dimension to the Institute's activities and allows participants to learn through the sharing of experiences and the examination of common problems. Participants are actively encouraged to contribute to learning activities and to learn from each other as well as from the teaching staff. Apart from its activities related to education and training the Institute provides opportunities for people to study and live in an internation environment of understanding and goodwill.

The International Training Institute fosters the personal development of its course participants by building self-confidence and encouraging members to create and present their own solutions to problems and to examine them objectively in discussion. Course participants are encouraged to bring with them relevant documents, reports and case problems, which outline their own situation.

Each course presented at the International Training Institute combines classroom activities with field visits if appropriate, and individual work attachments with organizations in Australia involved in work similar to that performed by the course member. There is thus a suitable balance between classroom study and practical experiences.

We are interested in establishing a Peacesat terminal at the International Training Institute.

We have made application for a licence and as soon as this has been approved, we will formally seek access to ATS-1.

ITI is keen to use ATS-1 in its Peacesat and Asiasat modes. In respect of this, we feel we could play a key role in encouraging the development of earth stations in those Asian countries which have potential but unrealised access to the satellite.

The applications to which ITI will put ATS-1 include:

- pre-course briefings for ITI fellows
- audio-conferencing sessions with experts in Pacific basin countries as part of our formal course work
- post-course support for ITI fellows
- opportunities for people to draw on our expertise through consultation via satellite
- inclusion of a satellite communication component in our regular media courses

For an example of how we intend to use the Peacesat network as part of our program, see the description of a typical course shown below.

We will be happy to make our terminal available other users in Sydney on a scheduled basis, if this is required.

It is hoped that we can be operating in the first couple of months of 1984.

ENVIRONMENTAL BROADCASTING IN THE SOUTH PACIFIC

Commencement date:
Monday, 26th March, 1984

Duration: 5 weeks

Course Outline:

Every country in the South Pacific is experiencing environmental problems - overfishing, soil erosion, water and air pollution, endangered wildlife, the destruction of coral reefs, deforestation, declining soil fertility, to mention only a few.

These problems are impacting adversely on the economies, life-styles and resource development of the region.

Environmental radio is an untried idea in the South Pacific, yet the nature of the problems demand that media organisations play a major role in raising public awareness of the environment.

The International Training Institute, in cooperation with the South Pacific Regional Environmental Program (SPREP), is offering this practical course in environmental broadcasting as part of a broader and continuing program to cooperate with countries in the region which wish to maintain and improve their shared environment.

This course relates to the broader activities of SPREP which is concerned with a more elaborate action plan for managing natural resources in the South Pacific.

In the field of radio broadcasting, supplementing this particular course, there will be

- pilot environmental radio projects in a number of South Pacific countries,
- follow-up visits to broadcasting organisations producing environmental radio programs,
- contact sessions with participating organisations through the Peacesat communications network,
- future environmental broadcasting courses.

12.2 UNIVERSITY OF QUEENSLAND'S PLANS FOR USE OF ATS-1

Professor John D. Chick

Director, School of External Studies and Continuing Education

The School of External Studies and Continuing Education is a recently established entity in the University of Queensland encompassing our Division of External Studies and Institute of Modern Languages and a new Continuing Education Unit. The rationale behind the establishment of the School relates to the University's intention to explore the inter-relationship between credit and non-credit programs and between distance education and continuing education.

As a first step we have commenced experimental activities with teleconferencing for professional groups and taken the initial actions necessary to obtain an educational broadcasting licence. We now wish to extend this progress through access to ATS-1 for experimental communication purposes to gain first hand experience.

At present Brisbane alone of the major cities in Australia is without a groundstation to link into the educational institution sub-net of ATS-1. The Queensland Police have a station and have been of considerable assistance to us in our planning but we are keen to plug the gap as far as higher education institutions are concerned.

In addition to completing the network for major cities our aims in seeking access to ATS-1 refer to our stated intention to expand our effort in Queensland in both credit and non-credit course provision. ATS-1 offers us the opportunity for experimentation and demonstration of the non-commercial applications of satellite communications technology in this field. We are interested to become an occasional station in the Kangaroo network and to contribute to the special sub-nets for tertiary distance education, public broadcasting and Queensland State. At this stage we would be an occasional user and contributor to all sub-nets.

In anticipation of our application for access to ATS-1 being acceptable we have set in train certain of the necessary steps to full implementation of the project. We have made application to the Australian Department of Communications for a licence to operate a satellite ground station. We have decided on equipment choices and the specifications for our antenna and its location in the University.

We hope to become fully operational participants in the Kangaroo network at the earliest feasible date. We undertake to provide full information to NASA and the Network Coordinator on the progress of our efforts for the compilation of reports.

12.3 CAPRICORNIA INSTITUTE OF ADVANCED EDUCATION'S PLANS FOR USE OF ATS-1.

Mr. R. Young,

Deputy Director

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This Institute is interested in making use of ATS-1 Kangaroo Net for experimentation with off-campus teaching. We have a main campus at Rockhampton in Central Queensland with a major study centre in Gladstone 112 Kilometers to the south, and would wish to place an earth station in both of these cities.

We recognise that time sharing on ATS-1 is very tight, and that regular teaching is not likely to be feasible. However, since we have a very large number of external students, we would like to gain satellite experience with off-campus studies prior to the launching of AUSSAT.

We would also anticipate joining in the Tertiary Distance Education sub-net co-ordinated by Dr. Kevin Livingston of Darwin Community College. The regular co-ordinators/operators would be Dr. John Dekkers and Geoff Arger at Rockhampton and Dr. Rob Sunderland in Gladstone, although as time progressed we would hope that other staff members would become familiar with the network and begin to use it.

We would like a regular weekly time-slot during day-light hours between 9.00 a.m. and 5.00 p.m. but realise that may not be possible, in which case we would be happy with 1-1½ hours per week between 7.00 p.m. and 10.00 p.m. Eastern Standard Time.

We would anticipate at this stage that we may be ready to start broadcasting some time in February and would optimistically suggest that the week starting the 6th February could be the target date.

In requesting this permission we give an unequivocal undertaking to supply information to the network co-ordinator for the compilation of annual reports to NASA.

12.4 ALBANY TECHNICAL COLLEGE'S PLANS FOR USE OF ATS-1

Alan R. Mitchell,

Principal

Over the last year the College has developed very close links with the Western Australian Institute of Technology, particularly through the Head of the External Studies Department, Mr. George Idle. The College offers programmes in this Region for students attached to WAIT as well as a wide range of External Studies in connection with Technical and Further Education in Western Australia.

The College, as well as having its two thousand (2000) part-time students and two hundred and fifty (250) full-time students, also has in excess of three hundred (300) students on External Studies within a region of one hundred (100) kilometres of the Albany region.

The ATS-1 Satellite facility would allow us to join the WAIT Net which will assist us in Administration and operation of courses for the External Studies Department of WAIT. It will also assist in the administration of the TAFE Teaching programmes being offered in this College both internally and externally. There will be opportunity of academic interchange with the WAIT, Bentley Campus and this College Campus, where staff members can jointly pursue areas of interest and research. The facility would provide the opportunity of student tutorials through the WAIT Net of Perth, Albany, Bunbury and Kalgoorlie. There will be both the formal communications and unstructured type tutorials, particularly those students involved in the Bachelor of Business, and Diploma TAFE Teaching. As well as those groups of students, individual persons may like to communicate with tutors/lecturers and administrators in Perth, on a one to one basis from this Region.

The College sees a wide and varied use made of the facility through community groups, for example, a member of the Aboriginal Council resides in the Albany region. We would encourage a joint hookup for aboriginal persons throughout the nation to confer on relevant issues.

There is also opportunity for accurate and cheap transmission of data for Agricultural groups, Professional Associations, and the development of community groups.

The College intends to instal a Kimberley RFK 102 H Transceiver and a Tono MR 25W linnear amplifier. Application has been lodged for a radio communication station license, and the appropriate fee of two hundred and fifty ($250) dollars paid.

We do give the undertaking required to supply information to the network co-ordinator for the confirmation of annual report as required.

13. ACKNOWLEDGEMENTS

The PEACESAT AUSTRALIA project is coordinated from La Trobe University as a joint effort between the Department of Electronic and Communication Science and the Department of Education's Media Centre. It was conceived in cooperation with the Satellite and Telecommunication Users Assotiation (SATUsers).

The financial assistance by the Commonwealth/State Advisory Committee on Educational Uses of Communication Technology is gratefully acknowledged. Some travel and incidental expenses incurred in preparation for the project were provided by the International PEACESAT Consortium. The equipment used at LA TROBE is part of the research work under grant from the Australian Radio Research Board. Antenna system was built as a student project by the Communication Engineering students.

The cooperation of Australian Department of Communications with licencing arrangements is much appreciated. Scheduling and access procedures were worked out with the kind permission of the Social Sciences Research Institute of the University of Hawaii and with the good graces of the other ATS-1 networks. All participating institutions have contributed from their own resources and have cooperated fully in the coordination process. The cover pages for this report and Kangaroo Network bulletins are provided by the Education Technology Centre in Adelaide.

The project owes its very existence to the generosity of NASA which provides the satellite free of charge.

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Dr. E. Steve Seumahu

AX 38

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(Co-authors: James Lange, Ray Casey, Bennit Dungua, Colin Dunnet, Gerald Knezek, John Flanigan, Elsa Flavel, Ed Houlton, Stuart Kingan, Kevin Livingston, Peter Scannell and Peter Spooner.)

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ANNEX:

ATS-1 IN PERSPECTIVE

N. George DAVIES, Department of Communications Canada
(Until Recently Special Advisor, Australian
Department of Communications).

E. Steve SEUMAHU, National Coordinator,
PEACESAT Australia Project
(Kangaroo Network).

INTRODUCTION

The expectation of a national communication satellite system by 1985 and the availability of NASA's ATS-1 satellite for prior experimentation have aroused a high degree of interest in the possible use of satellite communication for educational, community development and other public-welfare applications in Australia. Potential users in these areas are often referred to as "small users" due to their small scale of operation and low volume of traffic demand.

Several small user groups have already acquired low-cost earth stations and are carrying out experimentation using the two-way voice bandwidth facility on the ATS-1 satellite for point-to-point, broadcasting and teleconferencing applications. These groups are coordinated within the PEACESAT Australia project. All the earth stations are connected together into a network called the Kangaroo network.

They also have access to several Pacific wide networks which are serviced by the same satellite. ATS-1 has been used successfully for voice, facsimile, teletype, slow-scan television and computer communication.

The main objective of the PEACESAT Australia project is to give small users an opportunity for experimentation to discover their specific areas of application which would be best served by satellites. The next step would be an investigation of costs and benefits and ways and means of accessing an operational satellite system which would satisfy the proven need on a permanent basis. The most obvious option to be investigated in Australia is the use of the AUSSAT system expected in 1985.

The low user cost, ease of access and ease of utilization of ATS-1 may give experimenters a false sense of the economics of satellite communication and thus an unrealistic expectation of the capabilities of current technology. This paper discusses the current usage of ATS-1, the advantages and limitations of this particular satellite and future possibilities as far as Australia is concerned. AUSSAT features prominently as one of those possibilities. It is hoped that the paper will be of particular help to those people who are using the ATS-1 during the experimental phase and are now in a position to plan and make decisions regarding the use of AUSSAT first and second generation satellites.

THE ATS-1 SATELLITE

ATS-1 (Application Technology Satellite) was launched by NASA on December 7, 1966 [1]. It was a pioneer in geo-stationary satellite communication technology and was designed to carry out experiments to pave the way for operational systems. Among many other facilities the satellite carries a VHF (Very High Frequency) transponder which has enough bandwidth for 5 voice bandwidth channels. At the beginning of its life it produced a maximum of 40 Watts of RF (Radio Frequency) power. The antennas were of very simple whip-array construction, giving a global beam covering 40% of the surface of the earth. It was positioned at 149° West longitude, giving a footprint coverage between points as far West as Lae in Papua New Guinea and Washington D.C. in the U.S.A.

The satellite was designed to carry out NASA's own experiments for a period of 3 years. At the end of this period NASA invited proposals for the use of the satellite by small user groups in the Pacific and American continent. Several projects were initiated [2], including PEACESAT (Pacific Educational And Communication Experiment by Satellite), USP (University of South Pacific), ALASKA (Medical network) and DISP (Department of Interior Satellite Project). These projects were permitted to use the satellite as long as the station keeping and electronic systems remained operational.

Technical problems developed with the station keeping systems in April 1979, foreshadowing the reduction of usefulness to only 3 more years. A decision was made to move ATS-1 Westward in January 1982 to 164° East Longitude in order to conserve fuel. At this new location it is estimated that the satellite can be maintained in position until at least 1993. However, any failure in the electronic system would terminate the usefulness of the satellite before then. At this position, all parts of Australia can access the satellite. The new position corresponds closely to one of the planned positions of AUSSAT.

CURRENT USAGE OF ATS-1 IN AUSTRALIA

At September 1983 there was a total of 23 ground stations operational in Australia within the Kangaroo network with 3 more already licenced. It is expected that at least 15 more stations will be fully operational by 1984. These stations belong to various small user groups such as the University of Sydney, La Trobe University, S.A. Educational Technology Centre, the University of Western Australia, Darling Downs Institute of Advanced Education, Victoria Police, W.A. Police, N.S.W. Police, N.T. Police, S.A. College of Advanced Education, Footscray Institute of Technology, Darwin Community College, Canberra College of Advanced Education, Queensland Police, W.A. Institute of Technology, Australian National University, Australian Federal Police, Deakin University and W.A. Education Department.

The use of ATS-1 in Australia is coordinated from La Trobe University. Voice and computer teleconferencing are conducted regularly within 10 sub-networks which include regular and occasional stations, Packet Switching, Primary/Secondary Education, Police, Tertiary Distance Education, N.T. School of the Air, Batchelor College, W.A.I.T., Public Broadcasting and Queensland State sub-nets [3]. These sub-nets are convened according to a predetermined schedule.

THE ADVANTAGES OF ATS-1

There are many distinct advantages of ATS-1 for two-way voice-bandwidth teleconferencing and class-room applications. As with most communication satellites, FM (Frequency Modulation) is used hence static interference is reduced when compared to the terrestrial SSB (Single Sideband Modulation) high frequency (HF) system commonly used in distance education in Australia.

Because of the use of VHF, very high power can be produced at the satellite using well developed technology. With very simple on-board antennas, sufficient power reaches the earth to enable reception by very small and inexpensive ground receivers when the full power of the satellite is utilised to provide a single voice bandwidth transmission.

Two-way communication to and from the satellite is possible at very low cost on the ground because at VHF frequencies the transmitting and receiving equipment

are readily available off the shelf. These equipment have been used for more than 3 decades in terrestial applications such as two-way mobile and amateur radio services. Typical cost is $2,000 for a complete station using commercially available equipment. Some stations are constructed locally for lesser cost.

The global coverage of ATS-1 is a desirable feature for international and regional networking. At its present position ATS-1 can be accessed from South-East Asia, Japan, Australia and the whole Pacific region.

ATS-1 is directly accessable from ground equipment at the individual user's premises. No complex switching or DAMA (Demand Assigned Multiple Access) facility is needed.

The two-way access operates in the half-duplex mode. This means that only one station may transmit to the satellite at any one time, but this transmission is received by all stations in the network simultaneously. Operationally the transmission is initiated by a press-to-talk button or switch. Network operation and discipline are similar to those used in HF networks such as the School of the Air. Although this mode of operation is not suitable for telephony-type private-line full-duplex applications, it is simple and cheap to implement.

It has the advantage that only one talker is permitted at a time, thus promoting a very desirable network discipline on the users.

Another great advantage of the half-duplex mode of access is the in-built ease for teleconferencing and classroom applications. Only one single voice channel is needed by the network as a whole, independent of the number of stations in the network. In contrast, a similar teleconferencing arrangement using terrestrial and some satellite telephony configurations would engage twice as many voice channels as there are users in the network. In addition, the latter facility involves extra expenses and the inconvenience of having to arrange the teleconferencing interconnection through at least one telephone exchange. In the case of telephony type conference by satellite such complex switching arrangements would normally be accompanied by "double-hop" transmission delays whereas only a single-path delay is involved in the ATS-1 system. It is noted however, that a similar single voice-channel party-line arrangement to provide for unique educational requirements could be set up using a transponder on a domestic satellite.

THE DISADVANTAGES OF ATS-1

Although providing reasonable service at the present, the 17-year old equipment on board the satellite could malfunction at any time. Signal quality is not constant, being affected by polarization changes, orientation of the

satellite, state of the batteries and the age of the solar cells.

The biggest disadvantage of ATS-1 is the limitation of bandwidth. Although the bandwidth is wide enough for 5 voice bandwidth channels, it is only practical for 1 channel to be used at any one time because of the power limitation of the satellite. When more than one channel are used simultaneously, the limited power is shared among the users. Each user has a reduced power allocation with corresponding heavy reduction in signal quality. The user who transmits the most powerful signal to the satellite will over-ride all other users due to the FM capture effect. Another disadvantage is the presence of intermodulation distortion when more than one channel is used because of the non-linearities in the transponder.

To provide the single channel capability a total of 40 Watts of RF power is needed. This power level is easier to produce at VHF compared to microwaves. However, the same amount of power at microwave frequencies, where much greater bandwidths are available, could support up to 1000 voice bandwidth channels. To reduce the power per channel required by the VHF satellite would require very large VHF antennas. A satellite with large deployable antennas is extremely expensive to launch into space.

There are no commercial satellites available for VHF at the present although there are plans for an experimental UHF (Ultra High Frequency) system. The equipment being used for ATS-1 now will not be directly applicable to commercial

satellites as a complete replacement of the RF equipment and antenna system will be required.

Because of the very heavy use of VHF frequencies for terrestrial services, there is no provision in the international table of frequency allocation for VHF satellites except for amateur services. Even then the allowable bandwidth is very limited and could support only a very small number of voice bandwidth services.

VHF permits the use of very inexpensive antenna systems on the ground. A very simple structure provides a large capture area for receiving radio signals and pointing is not critical. This low directivity does have its disadvantages however, because it does not provide good discrimination against signals from closely spaced adjacent satellites. VHF satellites would therefore have to be widely spaced in the geostationary orbital arc and the total capacity for telephone communications would be quite limited.

Use of the ATS-1 is now free but realistically, in advocating the provision of a single VHF telephone channel for use over the Pacific, the potential cost of the channel has to be considered. One method of assessing the possible cost is on the basis of the RF power. Forty watts of RF power on ATS-1 is equivalent to one sixth of the total RF power of an AUSSAT satellite. A direct extrapolation from the projected charges for the total RF power of the AUSSAT transponders on one satellite would imply that one VHF

telephone channel would cost about $5m per year; a high cost for this voice service which would have to be borne by the users of the single channel. (The actual costing should take into account the fact that a single channel VHF transponder is less expensive than a multi-channel Ku-band transponder to manufacture).

POSSIBILITIES AFTER ATS-1

For Australia, the most obvious outcome of ATS-1 experimentation for small user groups is an appropriate use of AUSSAT facilities. This possibility is discussed further in the next section.

There may be economic and other reasons why the small users in Australia will not be able to utilize the first generation AUSSAT system. For example the volume of traffic may not justify the charges for satellite transponders or the cost of ground equipment. In these cases it may be economically attractive to examine other regional and international systems which can provide a very large coverage area. The aggregation of small users over the whole Pacific and Asian regions may make the use of satellite facilities cheaper than the aggregation over Australia only. In addition, a wider footprint covering such a large area would require much simpler antennas on a satellite and make practical the use of frequencies such as UHF to support cheaper ground stations [4]. Some possibilities are listed below.

INTELSAT is considering special reduced rates for small users in the Pacific region [5]. Australia already has some experience in the use of INTELSAT facilities for remote areas. The technology for 6/4 GH_z frequencies used on INTELSAT is well established.

There is likely to be some spare capacity on board NASA's TDRS (Tracking and Data Relay Satellite) system for use in the Pacific region. NASA is investigating the use of simple ground stations for this purpose. Such ground stations are also usable for the INTELSAT system.

At the Pacific Telecommunications Conference (PTC-83) there was extensive discussion on the possibility of a regional satellite system to serve those areas currently within the ATS-1 footprint [6].

Another possibility is the GLODOM (Global-Domestic Satellite System) concept proposed at ITU (International Telecommunication Union) for the sharing of satellite facilities by developed countries with the developing nations.

On the UHF range of frequencies there are several possibilities, for example the INMARSAT and the AMATEUR satellite systems. The development of MSAT (UHF Mobile Satellite) by NASA and the Canadian Department of Communications also merits a close study.

It is possible that the second generation AUSSAT will also include some provision for access by Western Pacific countries.

PROSPECTS FOR USE OF AUSSAT

The first two AUSSAT satellites are scheduled for launch in July and October 1985. They will each have eleven low power (12 watt) and four high power (30 watt) transponders and will operate in the internationally designated Ku satellite communications band of 12.25 to 12.75GH_z (500MHz wide). Each transponder will have a bandwidth of 45MHz which is sufficient to accommodate a maximum of 1,000 voice bandwidth channels, an equivalent number of data channels or a television signal. The transmitted power of each transponder will be concentrated into a beam which covers either all of Australia or one of four contiguous regions or zones in Australia or all Papua New Guinea, depending upon the individual transponder and the option selected for beam switching [7,8].

There will not be the capability on the first generation Australian domestic satellites to cover South Pacific Islands or the full hemisphere potentially visible from the satellite. The capability of these satellites is concentrated over Australia and optionally on Papua New Guinea. Because the satellites operate at microwave frequencies, it has been possible to obtain this concentration using antennas on the satellite which are approximately 1m in diameter, a size that can be accommodated very easily. To obtain the same concentration of power at VHF would have required an antenna of almost 90m in diameter, a size which would challenge the capability of the present satellite technology. (These factors, together with the wider bandwidths available at the higher frequencies, determined that the

first domestic satellite system would have to operate at microwave frequencies).

Given the uncertain life of ATS-1, it is important for the users of ATS-1 to assess the capability of AUSSAT to meet their needs. As discussed previously, AUSSAT will provide communications only over Australia and this will preclude exchanges with the Pacific Islands via this satellite. Within Australia, however, it would be technically feasible to design a single voice bandwidth channel using a small part of one transponder in a national beam. Within Australia, this channel could be used in exactly the same manner as the transponder on ATS-1. Participants would need to observe the same scheduling and network discipline as invoked for ATS-1. This single channel could be accommodated within a 12 watt transponder that was also allocated for other single channel per carrier communications purposes.

A typical earth station to use this shared voice bandwidth channel would have an antenna diameter of 2.5m, a transmit power level of about 1 watt and a receiver noise figure of about 2.5dB; specifications which are similar to those prepared by AUSSAT for minor earth stations. Present indications are that such earth stations would cost about $25,000 and there is some potential for cost savings if an earth station was assembled from subsystems. It is possible that towards the end of the 1980s, a transmit/receiver earth station could cost about $10,000.

With earth stations of this type, it has been estimated that approximately 200 voice bandwidth channels could be accommodated within one 12 watt transponder. On the basis of notional charges for transponder lease, it could be estimated, on a pro rata basis with some allowance for partial use charges, that lease charges for a voice bandwidth channel would be somewhat below $20,000 per year [9].

The capital cost of earth stations and the notional lease charges establish the scale of expenditure that would be needed for use of the voice bandwidth channel.

Policies regarding the potential for lease of partial transponder capacity from AUSSAT and the ownership of transmitting earth stations are still being determined. The constraints that might be imposed upon a common interest group joining together to share a voice bandwidth channel are therefore still to be defined. If such use is provided for, it would be necessary for such users to co-operate closely with AUSSAT to aid AUSSAT's development of a workable administrative and technical arrangement for sharing the use of a single transponder.

Sharing of a transponder for a number of independent services is already being considered by some agencies. Among these are the Departments of Education who, in co-operation with the Department of Communications, are developing concepts for the use of the satellite by the Schools of the Air, in the different States [10].

One concept involves each School of the Air class using two voice bandwidth channels, one for the teacher and one time-shared for students' responses. All of the present 18-20 simultaneous classes of the Schools of the Air could share a single transponder. Consideration is being given to use of voice receive only and transmit/receive earth stations somewhat smaller than 2.5m in diameter to reduce logistics problems but recognising that use of smaller earth stations would decrease the total number of voice bandwidth channels that can be provided through one shared transponder.

CONCLUSIONS

The ATS-1 satellite has proved to be a boon for Australian small users to obtain first hand experience in satellite communication and to explore the areas of application best suited to this technology. Many small user groups are taking advantage of this opportunity.

Although the access and utilization of ATS-1 is very convenient and involves very little cost, the carrying over of the experience to a more permanent set-up requires much thought and planning. The ATS-1 technology has severe limitations. This technology is not available on existing or future commercial systems.

AUSSAT offers facilities which could be useful to Australian small users. Current studies by AUSSAT and the Department of Communication have paved the way toward the exploitation of these facilities. For reasons of volume of traffic and areas of coverage some needs which have been revealed by the ATS-1 experience may be met more economically

by different systems on a shared basis with other regional and international small users.

ACKNOWLEDGEMENTS

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